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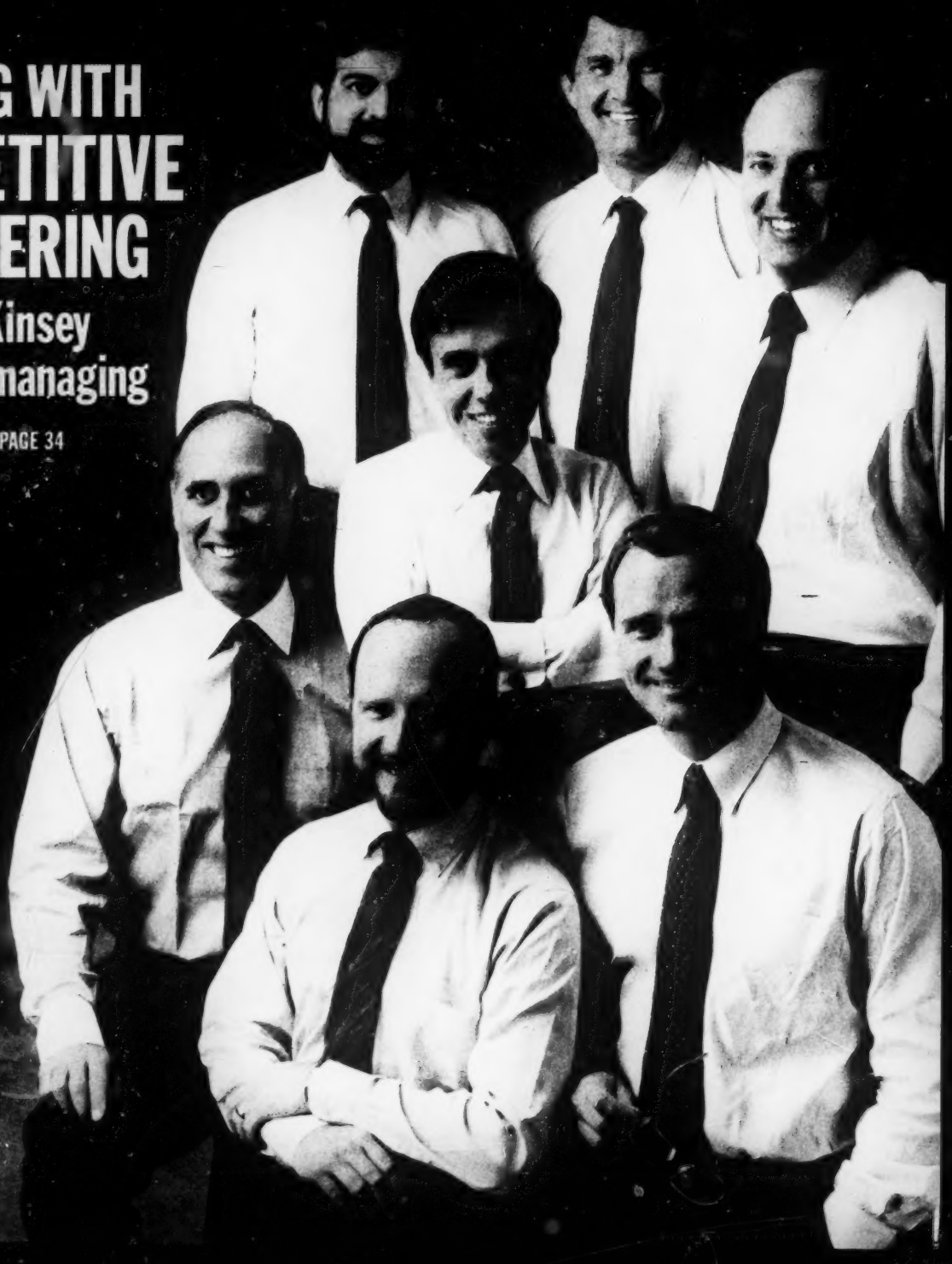
Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER & SYSTEMS COMPANIES — WORLDWIDE

JANUARY 9, 1989

WINNING WITH COMPETITIVE ENGINEERING

A new McKinsey series on managing engineers PAGE 34



McKinsey & Co.
Electronics practice

Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER AND SYSTEMS COMPANIES WORLDWIDE

VOL. 15, NO. 1 JANUARY 9, 1989

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34 How to win with competitive engineering

Of all the functions that are performed by managers in the electronics industry, engineering may be the most vital and least understood. It lies at the very heart of the creative impetus that has made electronics the premier industry in the world. At the same time, engineering is frequently cited as the Achilles' heel of the industry. This first part in a new series by McKinsey & Co. will explain how engineering managers and corporate executives can harness engineering to give their company the competitive edge.

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Welcome back, McKinsey

Back in the early 1980s, just as the U.S. electronics industry was gathering real momentum, ELECTRONIC BUSINESS ran a series entitled "Keeping the Competitive Advantage," authored by consultancy McKinsey & Co. The highly acclaimed articles provided insight into a myriad of ways to improve business, from cutting product development time to managing joint ventures.

We're pleased to welcome McKinsey back. In this issue, they return with the first article in a series on management of engineering resources. The theme is "Winning with Competitive Engineering," and it's a theme you'll hear consistently as the series unrolls throughout 1989.

McKinsey's earlier advice was timely; the new series is no less appropriate. U.S. electronics firms may be leaner, meaner and more astute than ever before, but the challenges they face are tougher still.

We're supporting the series with two special ELECTRONIC BUSINESS seminars this month: one on Jan. 11 in San Jose, the other is on Jan. 18 in Boston. On both coasts, we're inviting our senior-management readers to meet the McKinsey authors to learn first-hand about the new strategic directions in engineering.

What's ahead in '89

For this issue, the editors at ELECTRONIC BUSINESS linked up with the economists upstairs in Cahners Economics to produce penetrating and original forecasts for each industry sector in the year ahead.

Our "Outlook 1989" section is no mere regurgitation of old data from the usual forecasters. It's based on detailed scrutiny of the economic tea leaves by Cahners' underrated analysts: James Haughey, Elizabeth Baatz and Madeline Franchi. Their findings, and our editors' presentations, should form crucial components of every manager's short-term planning.

McKinsey & Co.'s Electronics Practice consulting team

Kilts and Kisses

We're also proud of this issue because it debuts a new section that we're calling "Management Styles." If the executive profiles it runs recall a certain page in *Time* magazine, that's no accident: people love reading about other people.

There's a distinct difference, though: recognizing that our senior-management readers have business to attend to, the new page connects the executive's personality firmly to the way he or she does business. Kilt swirling, kisses flying, LSI Logic president George Wells is our first candidate as senior editor Valerie Rice captures the essence of "Management Styles."

JOHN KERR, editor

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VBPA ABP

Japan aims to star with flat panel in-flight flicks

Consumer electronics are Japan's key to the lucrative airplane cabin. Next flight, the plan is to put LCDs into the cockpit too

Japanese electronics are starting to show up in the booming market for commercial aircraft. But don't credit Japan's highly touted targeting of the aerospace industry yet. Credit Japanese consumer electronics technology.

Japan already runs a sizable aircraft industry: annualizing figures from the Japan Society of Aerospace Companies, 1988 revenue approaches $4 billion, with over $500 million of that in aviation instruments and communications equipment. And the nation's Ministry of International Trade and Industry (MITI) this year is plowing $148 million into aerospace research, a 42% gain on fiscal 1987.

But that's not what's behind Japan's push into in-flight entertainment. It's the nation's consumer-electronics producers that expect to be a big force in passenger entertainment systems that use flat panel liquid-crystal displays to screen movies in the backs of the seats. They are also targeting the cockpit, where new collision-avoidance systems may provide big revenue for flat panel displays.

Although not the sort of thing one usually thinks of as "avionics," these flat panel seat-back TV systems are one of the biggest potential growth areas for electronics on aircraft. At roughly $2,000 a seat to install the system on some 1.3 million seats on 6,000 commercial aircraft, there's a potential $2 billion to $3 billion market in the U.S. alone. The systems may start to show up on commercial flights as early as this year.

It's not a Japanese company that's ahead so far, though. It's Airvision of Valencia, Calif., a joint venture of N.V. Philips GL and Warner Communications Inc. "We're planning on installation [this] year," says Albert Ruimschotel, Airvision's senior vice president for marketing. "We're the only ones flying yet."

Northwest Airlines recently concluded a five-month test of the Airvision system on a 747 flying between Detroit and Tokyo. British Airways and Australia's Qantas Airways are currently testing the system, which uses off-the-shelf 3-inch LCDs from Philips.

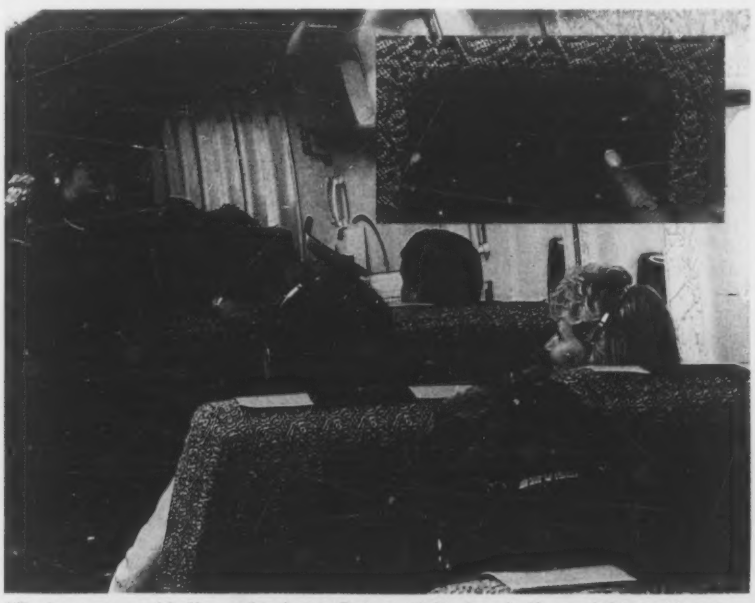
A Northwest spokesperson says the airline is encouraged by the enthusiastic passenger response, but is still evaluating the economics of the system. More than 70% of the passengers on the test plane watched the in-flight movies and television programs four hours or more on the 13-hour flight, felt the rental was a good value at even $8, and said they would choose to fly next time on an airline that offered the system.

Japanese consumer electronics giant Matsushita Electric Industrial Co. also plans to be a big player in the seat-back video market. The company says Japan Air Lines will install its system in its new 747-400 aircraft when it takes delivery from The Boeing Co. of Seattle. Matsushita is already a major supplier of entertainment systems for commercial aircraft, claiming up to 50% of the roughly $75 million audio market, largely from supplying its systems to Boeing. And it has a U.S. marketing structure ready to go: its 30 sales reps at Matsushita Avionics Systems in Bothell, Wash., already have established relationships with major U.S. airline customers from the audio business.

Matsushita is designing a system specifically for aircraft, which will be lighter and more rugged than existing systems put together from off-the-shelf components, and which will use a 5-inch LCD screen in the seat arm. The company is supplying its regular industrial video hardware on an OEM basis for several of its competitors' seat-back video systems as well.

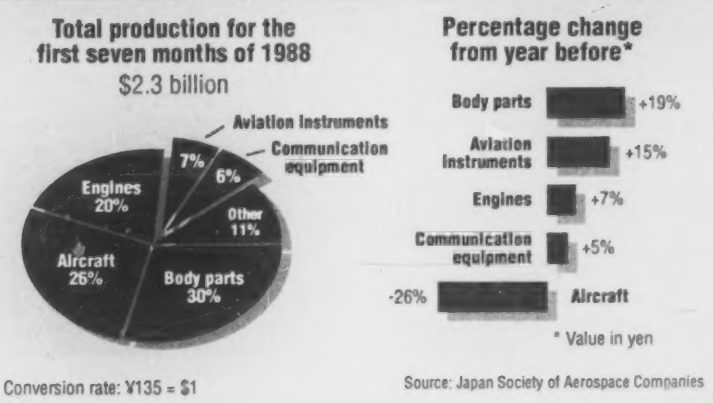
Virgin Atlantic Airlines is also reportedly talking to several Japanese vendors about installing 5-inch video systems on the London-Tokyo flights it initiates this spring.

Outside of entertainment systems, the Japanese presence in the U.S. avionics market has been minimal. Limited figures from the U.S. Commerce Department put Japanese imports of electronic measuring instruments, auto control instruments and naviga-



"Fasten your seat belts, and put your flat panel displays in the upright position." U.S. vendor Airvision made the displays for this "flight test"

Japan's aviation instruments business soars



Electronics is a fast-growing sector of Japan's already large aerospace business

tional instruments for aircraft at under $8 million in 1987, although that is nearly double 1985 levels. Major system suppliers report no Japanese competition for their products, and little use of Japanese components.

Cockpit displays

Soon, though, significant numbers of Japanese flat-panel displays may start showing up in cockpits too. Mitsubishi Electric Corp. already supplies dedicated very high resolution CRTs for cockpit displays in some Boeing planes. And Japanese suppliers are involved in the development of the coming flat panel instrument displays.

"The Japanese have made large commitments to flat panel consumer television and, more important, 8- by 10-inch video data terminals, and we're counting on that kind of volume to reduce costs," says Phil Fenner, manager of displays and sensors for Boeing.

Boeing started work with the Japanese on a very high resolution, multipurpose, large-screen flat panel cockpit display for the 7J7, a new propjet that was to be developed with Japanese partners. Although the 7J7 program was shelved indefinitely for want of market interest, the display program was not. "It's moving forward just about as it was under the 7J7," says Fenner. The display is now targeted at derivative airplanes for the early 1990s. Boeing is working with three of its usual systems suppliers which will package and assemble the display, while Japanese companies focus on the key active matrix liquid crystal units. Involved in this and other Boeing flat panel programs are Seiko Epson, Hosiden Electronics Co. Ltd., and Stanley Electric Co. Ltd. "We're trying to get Sharp interested too," notes Fenner. "They have very good technology."

Coming even sooner are smaller, simpler flat panel displays to replace existing dedicated readouts. Boeing has a joint development program for these as well. Rockwell International Corp. bills the monochrome display for its Rockwell Collins data link system as the industry's first commercial flat panel active matrix cockpit LCD.

Mitsubishi already supplies CRTs for cockpit displays in some Boeing planes

But the first big market for flat panel cockpit displays is likely to be in collision avoidance systems. These new $100,000-plus systems are required by law by the end of 1991 on all of the 6,000 or so aircraft with more than 30 seats that fly in the U.S. Systems suppliers Rockwell and Allied-Signal Inc.'s Bendix/King Air Transport Avionics Division are both offering airlines a flat panel display option, combining the traffic alert information with the vertical airspeed indicator in a 3-inch flat panel display that would not require unusually high resolution. Japanese LCD makers are prime contenders to supply the glass for these displays.

In the less flashy business of avionic flow meters, switches and power supplies, the Japanese are selling products too. "We lost business on the F-15 fighter," notes Robert Brown, vice president of technology and central operations at Eldec Corp., a Lynnwood, Wash., maker of airborne power supplies. "And for the 7J7, Japanese companies were making a strong approach in things we had supplied."

Old-boy network

Despite these successes, it's not easy for the Japanese to break into the old-boy network to sell avionics systems outside of Japan. The airlines each specify the electronics on the planes they buy, and both airlines and air frame makers are used to dealing with a small fraternity of well known vendors. "We deal with vendors who're familiar to us," notes Frank Rasmussen, Boeing's chief engineer for flight management. "Electronics on aircraft tend to be custom — indeed more so than we'd like. There's lots of customer interface in electronics."

One way into the fraternity may be by financing development of the next generation of U.S. aircraft. The Japanese stand ready to chip in on the development of new planes whenever the market is ready for them. Although Boeing shelved the 7J7, the Japanese government didn't stop funding for the project: it continues at about $30 million a year, and roughly 40 Japanese researchers continue to work at Boeing.

Reports from Japan say the Japanese are talking with Boeing about participating in the development of a stretched version of the 767. Mitsui & Co. plans equity participation in McDonnell Douglas Corp.'s new propjet, if there's enough customer interest to start the project. "The target is the same as Boeing," says M. Sugaya, Mitsui's general manager of industrial machinery in Los Angeles. That goal, he says, is "more opportunities for Japanese vendors."

PAULA DOE

Board makers see reward in Motorola's RISC chip

Although late to the race, Motorola's 88000 processor is proving popular with board vendors, thanks to the 68000's reputation

Like a surfer intent on riding the biggest wave, independent add-in board makers are hoping to catch big profits on the RISC technology swell. Just which supplier of the speedy RISC architecture will provide that big wave remains to be seen, but for the moment Motorola Inc.'s 88000 microprocessor family — a latecomer to the RISC market — is forming the basis of at least 10 board makers' efforts.

Backing a particular RISC chip is a high-stakes call; RISC-based boards will likely become a substantial peripherals business. In VME bus boards alone, 25%, or $275 million worth, will be RISC-based by 1992, says the VMEbus International Trade Association (VITA). VITA's figures for the total world board market come to $1.9 billion this year, rising to $2.3 billion in 1990; if a quarter of all boards feature reduced instruction set architectures by 1992, the opportunities could be huge.

Many other RISC chips were up and running before Motorola unveiled its offering last spring: Intergraph Corp.'s Clipper; the Sparc design licensed by Sun Microsystems Inc. to IC makers such as Cypress Semiconductor Corp., LSI Logic Corp. and Fujitsu Microelectronics Inc.; and the architecture developed by MIPS Computer Systems Inc. The RISC roundup also includes the 29000 microprocessor from Advanced Micro Devices Inc.

But the 10 or so independent board builders betting on Motorola are doing so chiefly on the strength of the chip maker's reputation for meeting customer demands and producing quality microprocessors. Says Robert Gilks, CEO of Tadpole Technology Inc.: "We have worked with them before and have a very high regard for the Motorola product." (Tadpole hasn't ruled out using other RISC vendors.)

Others claim that the 88000 is simply a better, broader-based architecture. Enthusiasts boast that the 88000 stands out because of its two cache memory support units and multiprocessing, built-in fault tolerant capabilities and the integration of floating-point and integer functions on the CPU chip.

Tadpole spent close to $2 million of its $8 million revenue on R&D to harness RISC. Other board makers that have announced an 88000-based product include Integrated Micro Products Ltd. (IMP); Tektronix Inc.; Northern Telecom Inc.; and Force Computers Inc. IMP, with estimated 1987 sales of $10 million and over $1.5 million plowed into R&D on RISC boards, claims it was one of the first to market 88000 boards.

Besides the recent boom in RISC workstations, the board vendors are responding to growing applications in imaging, high-end simulation, embedded communications and office automation. RISC, observers say, will be implemented into any highly repetitive application allowing users to increase current computing power up to 30 times. "The challenge for the board industry is to be innovative to do what CISC can't," according to Marty Weisberg, Force Computer's executive vice president.

VMEbus board market

RISC-based boards' share of total market ($ millions)

Source: VMEbus International Trade Association

One big user could electrify the RISC board market: Apple Computer Inc. Although Apple remains tight-lipped, there is word that the PC giant, whose Macintoshes already use Motorola's 68000 processors, is eyeing the 88000. However, if Apple does introduce a RISC-based system, many companies will be interested in making add-in boards for them, according to Andrew Allison, editor of *RISC Management*, an industry newsletter.

Since last April Tektronix has been marketing a systems development board for the Macintosh II designed around the 88000. Depite no volume silicon deliveries, Tek says sales of the board have been good. Depending on the amount of memory desired, Mac II users can expect to pay from $11,000 to $15,000 for the board. (Motorola indicates that add-in RISC boards will typically sell for $5,000 to $10,000.)

Ultimately, Motorola's market timing may have cost it business. "Where's the beef? Where's the silicon?" complains one board maker that has used Motorola's technology in alpha-site trials and is now waiting to employ the 88000 in volume. Several board manufacturers using other architectures say they did so because of availability. "We realized that we had to go to RISC architecture three years ago and the only architectures on the market then were Clipper and MIPS," says Forest Baskett, vice president for R&D for Silicon Graphics Computer Systems, which uses the MIPS version to enhance its graphics boards.

Volume shipments are on the way in early 1989, says Motorola; total shipments of the 88000 family should reach 50,000 by the end of this year, with ramped up production in 1990 and beyond. Motorola believes its timing isn't so bad. With software compatibility a key downside to implementing RISC technology, the company claims the 88000 will have standardized software in existence before volume 88000 is available — something observers say has never been done before. Already the 88open Consortium Ltd. has unveiled a Binary Compatibility Standard (BCS) that hardware and software vendors will be using to build 88000 products.

JOHN McCREADIE

Replacing the weakling of the workstation world

IBM's RT has been big on family connections, short on performance and pathetic on sales. The Armonk giant has to change that this year

BY RICK WHITING

Underpowered and overpriced, IBM's RT workstation is often mentioned in the same breath with such other notable Big Blue Edsels as the PC*jr* microcomputer.

But unlike the stillborn PC*jr*, IBM has stuck with the RT and this year, more powerful versions of the workstation are on the horizon. With IBM's marketing muscle and huge customer base, analysts say a competitive RT has the potential to remake the workstation landscape.

"They will come out with a blockbuster that will set the standard for this industry, just as they set the standard for the PC industry," predicts Charles Foundyller, president of the Daratech Inc. CAD/CAM market research firm in Cambridge, Mass.

The difference, however, is that while IBM virtually created the PC market, the workstation business has been booming for several years without IBM's help, leaving the company with some catching up to do.

The RT made its debut in January 1986, and even IBM executives acknowledge that the early versions were computational lightweights. "We made an error in that it was not as powerful as it needed to be and did not have the suite of applications it needed," says Linda Fabel, director of AIX and technical workstations.

Since its unveiling, the RT has been enhanced about once a year. From the first workstation's performance of about 1.5 million instructions per second, the system's power has increased steadily to its current top-of-the-line performance of about 5.5 MIPS. Pricing for the workstation line now ranges from about $23,000 for a low-end system to about $32,000 at the high end.

IBM's director of AIX and technical workstations, Linda Fabel: "We have had to overcome a negative image of the RT within the market"

Lagging price/performance

But the RT has continued to lag behind workstations from other vendors in price/performance. Apollo Computer Inc.'s Domain 4500, rated at about 7 MIPS, has an entry-level price of $18,990, while Sun Microsystems Inc.'s Sun-4/110, also with about 7 MIPS performance, has a starting price of $18,900. "It's been a dollar long and a few MIPS short throughout its life," Foundyller says of the RT.

Based on an IBM proprietary reduced instruction set computing (RISC) architecture, the RT hardware is also incompatible with the rest of IBM's computer systems. Another technical Achilles' heel is that its graphics are poorly integrated with the rest of the system, according to several analysts and industry competitors.

But the RT has suffered from marketing shortcomings as well. Foundyller points to IBM's own view of the RT as little more than a high-end PC. "They didn't really understand that they were competing with the Apollos, the Suns and the Hewlett-Packards," he says.

Symptomatic of that was the original name of the product, the "RT PC." Last August IBM dropped the "PC" in an effort, "to restructure the thinking of the end user to look at the RT more as a technical workstation and less as a high-end PC," Fabel says. The move was seen as a response to criticism that IBM has failed to clearly distinguish the RT from its Personal System/2 line.

Nevertheless, the IBM logo alone has been enough to sell the RT to some users. "It has the family connections," Foundyller says, "all it

needs is some power. It's a Dan Quayle."

Several research firms, including International Data Corp. and Dataquest Inc., put total sales of the RT at around $300 million in 1987, the last full year for which figures are available. But the consensus among industry watchers is that about two-thirds of all RTs are sold as multiuser systems — particularly in Europe, where Unix is more readily accepted for commercial applications — with only one-third sold as standalone workstations for traditional CAD/CAM applications.

International Data Corp. analyst Vicki Brown calculates that in 1987, sales of RTs as single-user workstations generated $102 million in revenue for IBM, giving the company a 3.9% share of the $2.6 billion workstation market worldwide. She puts the sale of RT workstations in 1986 at $48.3 million, giving IBM a 4.1% share of that year's $1.2 billion market. Although statistics are not yet available on how much of the estimated $3.9 billion workstation market IBM captured in 1988, analysts do not believe the vendor's market share has changed.

Missing out

While $300 million in sales would be considered respectable for many vendors, it represents just 0.55% of IBM's 1987 revenue of $54 billion. But IBM realizes that it is missing out on a huge market unless it becomes serious about the RT, says Prudential-Bache Securities Inc. analyst Rick Martin. He notes that the workstation market is expected to grow over 30% this year, much faster than the mainframe and PC markets — which the analyst expects will grow 8% and 17%, respectively, in 1989 — where IBM makes its living.

"If they don't become a major player in the workstation market, IBM will be relegated to single-digit growth," Martin foresees. "We believe they will be fairly aggressive in trying to gain a share of that market."

So what does IBM have up its sleeve for the RT in 1989? Fabel will only say that the company has "dramatic development plans for the RT." Martin says his information is that IBM plans to boost the performance of the workstation to between 15 and 20 MIPS, while Foundyller says he has been told by IBM executives that the more powerful RTs will be "competitive with anything that is out there."

"They are very serious about it," Foundyller says. "They just haven't got it right yet." Looking even further ahead, a Salomon Brothers Inc. research report projects the RT to have the power of a 3090 Model 200E mainframe — about 32 MIPS — by 1990. Foundyller adds that IBM executives are even talking about a system in the range of 100 MIPS by 1992 to 1993.

IBM realizes it is missing out on a huge market unless it becomes serious about the RT

Recent technology deals with Silicon Graphics Computer Systems and Next Inc. also offer additional evidence that IBM is serious about improving the RT. IBM is expected to add Silicon Graphics' "Iris" three-dimensional graphics products to the RT and has licensed Next's "NextStep" user interface and developer tool kit for possible use with the workstation.

IBM is looking to overcome the incompatibility issue through the use of AIX, IBM's version of Unix. AIX applications for the PS/2, RT and 370 mainframes will be source-code compatible and only require recompiling to run on each architecture. "We have very deliberately defined the high-end PS/2s (the 80386-based Models 70 and 80) and the RT as an AIX family," she says. AIX for the PS/2 is due this quarter, according to Fabel.

Further evidence of IBM's intentions came last month when the company created the Advanced Workstations Division to oversee RT development efforts. The move followed the departure of president William Lowe and the break-up of the Entry Systems Division which previously had jurisdiction over the RT.

Research and development on the RT and AIX are combined at IBM's Austin, Texas, facility. Although IBM has described its AIX development effort as a massive project, Fabel does not disclose the amount of resources devoted to the RT.

IBM's advantage

On the marketing side, IBM has an advantage in that it is generally acknowledged to be the No. 1 vendor in the CAD/CAM arena, with Daratech estimating its share of the $5.2 billion market in 1988 at 25.4%. The company holds that market position with its mainframe computers running such CAD/CAM software as CATIA, CADM, CAEDS and

Your move, Mentor

A decision by Mentor Graphics Corp. to add an IBM, DEC or Sun workstation to its product line will go a long way toward boosting the fortunes of that vendor in the workstation market.

Mentor, a $300 million supplier of design automation systems based on Apollo Computer Inc. workstations, is considering adding a second platform to its arsenal sometime this year. While a workstation from Sun Microsystems Inc. may have been the clear choice in the past, Mentor president Gerry Langeler says the decision is no longer an easy one.

"It's been kind of a nice, simple, easy-to-understand battle," Langeler says of the workstation market to date, and that until now, Sun was the obvious alternative to Apollo. "Sun will still be a good choice in 1989, but it may not necessarily be the obvious choice."

Although adding a second platform is not a certainty, Mentor is "putting all the steps in place if we choose to do so," Langeler says. Mentor has been briefed on future products by Digital Equipment Corp., IBM and Sun, which the president calls "the three most obvious choices."

A second platform would incrementally increase Mentor's sales, Langeler says, but he acknowledges that it would likely cannibalize some of the vendor's sales of Apollo workstations as well. □

CIEDS, and that user base could provide fertile ground for RT sales.

Fabel says IBM will continue to target both technical and commercial markets for RT sales. Although she says third-party sales of the system began to pick up in 1988, she admits: "Clearly, we would like to have more resellers utilize it and remarket it." IBM now has several hundred remarketers that carry the RT, Fabel estimates, but she acknowledges that some sell the workstation in relatively small quantities.

IDC's Brown says IBM is "having trouble convincing people that they are serious about workstations. They have to overcome the perception that IBM is not a workstation player and that their products are subpar." Fabel concurs by saying: "We have had to overcome a negative image of the RT within the market."

Despite IBM's presence in the CAD/CAM market, Brown says technical computing accounts for only 10% of the company's sales and that the vendor's real marketing strength lies in the commercial area.

Yet, that is seen as an advantage by William Zarecor, executive vice president of workstation vendor Intergraph Corp.'s Clipper Products Division. He maintains that information system managers, with which IBM wields great influence, often do the computer buying for both commercial and engineering departments.

"The question, as is often the case with IBM, is how they are going to position it," Martin says, referring to the pricing of the new RTs. He says that if the pricing is competitive, "there is no reason for them not to be successful." Fabel says IBM plans to hold RT prices at their current level while increasing the performance.

Digital Equipment Corp. soon is expected to debut its first workstations based on RISC microprocessors from MIPS Computer Systems Inc. Martin believes that if those systems are competitively priced, IBM will have to follow suit, in turn setting the tone for the whole market.

How else will the workstation arena be affected by a competitive RT? While Foundyller says that such a product could boost growth for the overall market by making it "more respectable," he believes a powerful RT will turn up the competitive heat on other workstation vendors. "I think it will hold back the growth of the strong and wipe out the weak," he says.

Dataquest Inc. analyst David Burdick is more skeptical. "Right now it's difficult to see how IBM is going to be a player with the RT. It's hard from my point of view to see how the RT is ever going to become an overnight success."

Other workstation vendors profess to be unworried by the prospect of a suddenly more competitive IBM, even though Mentor Graphics Corp. president Gerry Langeler says that, "To count IBM out in any computer market is foolhardy."

Offensive

As the leader in the workstation market, Sun Microsystems Inc. is the likely target for any workstation offensive. While IBM is not about to put Sun out of business, Foundyller says a strong RT could limit the growth rate of the high-flying Mountain View, Calif., company and force it into the secondary role that Apple Computer Inc. now plays opposite IBM on the PC stage.

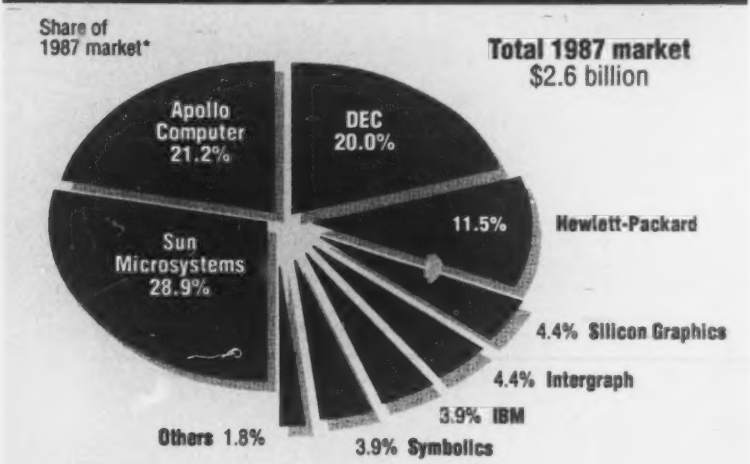
"I think it's natural for competitors to target the leaders in the market and at this point I don't think IBM can ignore what Sun has done," says Cheryl Vedoe, marketing director for Sun's workstation division. While also acknowledging that Sun cannot afford to ignore IBM, Vedoe says Sun's game plan for remaining in front is to continue its current strategy of staying "on the leading edge of technology."

Market-watcher Martin believes that if IBM's pricing is very aggressive, Sun may be forced to respond. That could hurt because Sun, in its efforts to quickly gain market share, is operating on very thin profit margins.

"So far, [the RT] has not been a serious competitor in the workstation market," says Don McInnis, vice president of DEC's engineering systems group. He argues that the workstation is incompatible with the rest of IBM's product line and that technical computing is not IBM's strongest market. "I think that even if they had a stronger product, the RT would still have some fundamental problems."

"I think [a stronger RT] will make the workstation market more competitive," says John Thompson, senior product manager for personal workstations at Apollo. But he echoes executives at Sun and several other workstation companies by arguing that it is easier for smaller vendors to maintain a technological lead over giants like IBM. □

Worldwide workstation market



* Most recent year for which statistics are available.
Analysts project that vendor share of estimated $3.9 billion 1988 market will be comparable to 1987

Source: International Data Corp.

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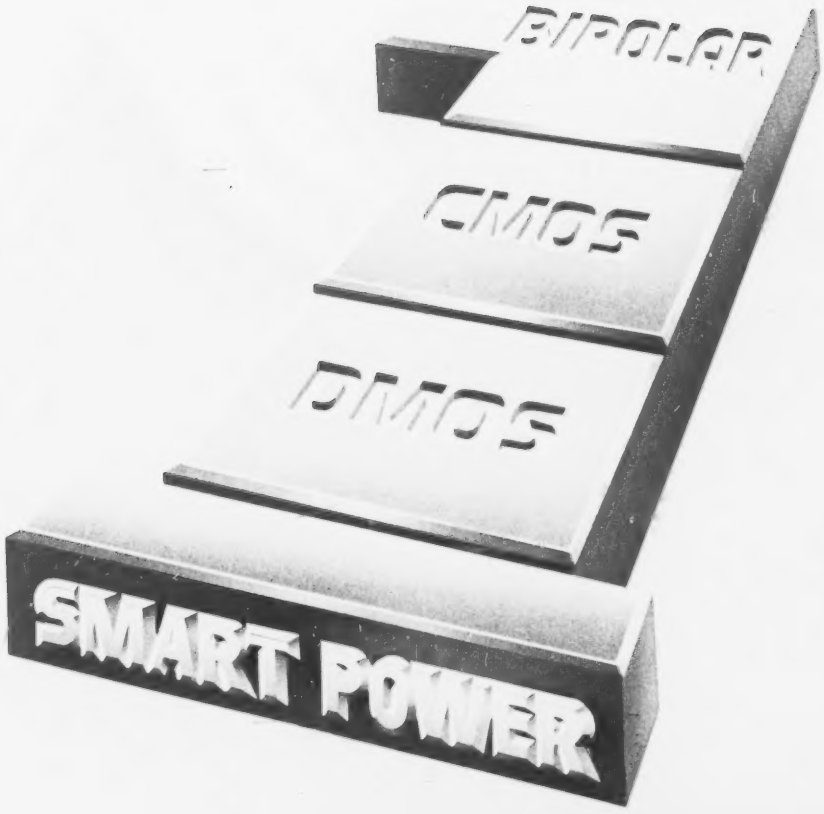

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MICROELECTRONICS

Where's that recession?

It likely won't show. What will show in 1989 is a moderate contraction — unless Bush continues to ignore deficit realities

BY JOHN KERR

There's never been a recession like it. Books have been written about it. Careers have been built on it. People have died waiting for it. The funny thing is, it's the recession that hasn't even happened.

Continuing one of the longest peacetime economic expansions ever, 1988 closed with a U.S. economy that looks as healthy as can be. Growth in the gross national product is robust; the merchandise trade deficit is expected to drift down to $135 billion for the year; exports are on the up; and a pro-business George Bush joins the White House gang two weeks from now.

The trouble is, the good times won't last a lot longer. While they won't about-face into awful recession — defining recession as negative economic growth in three consecutive quarters — they will lose their shine as the economy backs into a slow-growth mode. The electronics sector, the largest in the U.S. manufacturing industry, cannot expect economic amnesty, either. With deficit difficulties rampant, nobody asks "How come?" any more. The only questions are how soon, how slow and how long.

Warns Gilbert Amelio, president of Rockwell International Corp.'s Communications Systems division: "The so-called strong economy we've been experiencing is paper-thin."

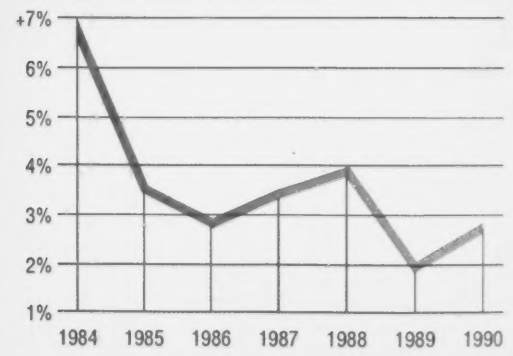
The oracles have fingered 1989 as the turndown year for over a year now. Many of the more sinister omens are beginning to line up: national unemployment rates had, by mid-November, dropped to 5.3%, breeding rumors of inflation and fears of reactive interest rate hikes; trade and federal budget deficits showed up, bloated and still hungry, at Bush's door; and the background muttering over America's fiscal irresponsibility is beginning to rise to a growl everywhere from Tokyo to London to Rome, prompting concern that soon — very soon — *something must be done.*

So far, something is not being done. Hobbled by its own "Read my lips, no more taxes" manifesto, the incoming Bush regime shows an alarming apathy toward those twin terrors, the obese budget and trade deficits. One week after Bush's electoral victory, Federal Reserve Board chairman Alan Greenspan was warning that the United States cannot grow its way out of the budget deficit.

It's not clear how much the

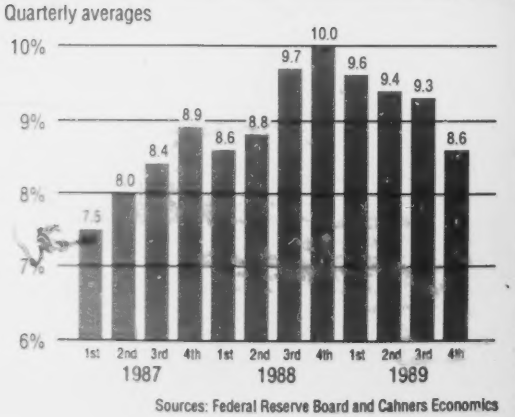
The economy

Gross national product



Sources: U.S. Commerce Department and Cahners Economics

Prime rate



Sources: Federal Reserve Board and Cahners Economics

Gramm-Rudman budget-balancing laws might curtail calamity; Congress seems far too resistant to the notion of across-the-board cuts. What is clear is that much depends on tax action — even if Bush doesn't admit to it being called that. According to Edward Henderson, president of Sunnyvale, California-based forecaster Henderson Ventures, the Fed chairman may soon be compelled to give America's chief executive a tough ultimatum: "If you don't raise taxes, I'm going to have to raise interest rates." And next to taxes and inflation, interest rates are the scariest thing going to most U.S. businessmen.

Most bets are that the new administration *will* hike taxes: Henderson predicts a 90% chance that consumer-oriented (read spending side) "revenue enhancements" will be in effect by midyear.

Crucial harbinger

There is one event that will be a crucial harbinger: the president's economic report, due out later this month, which details the nation's budget for fiscal 1990. "If there's nothing in there about deficit reduction, then we've got some real problems," says David Wyss, chief financial economist at Data Resources International (DRI) in Lexington, Mass.

The specifics are clear: America's gross national product (GNP) will inch up just 1.9% this year, compared with the 3.9% rise seen last year and 3.4% step in 1987, according to Cahners Economics, the economic research arm of Cahners Publishing Co. Inflation, based on consumer prices, will jump the 5% bar this year, helping to puncture consumer confidence. Growth in business investment dollars, according to Cahners, will fall back to 1.7% this year after a 9.4% surge in 1988. And growth in total industrial output will go negative, shrinking by 0.2% in 1989.

One source says there's a 90% chance that Bush *will* hike taxes by mid-1989

The U.S. electronics industry will mirror the trend. The ELECTRONIC BUSINESS leading indicator, an economic pointer that predicts turning points in U.S. semiconductor sales with about a three- to nine-month leadtime, is heading inexorably downward, a slide it began in October 1987.

Last fall, the semiconductor sector's order bookings fell below the level of orders that it was shipping, a pattern that Cahners sees worsening in the second quarter of this year. Computer sales — even in previously fast-paced PC and workstation segments — are taking a breather as users sort out the mixed messages coming from the folks setting computer operating standards.

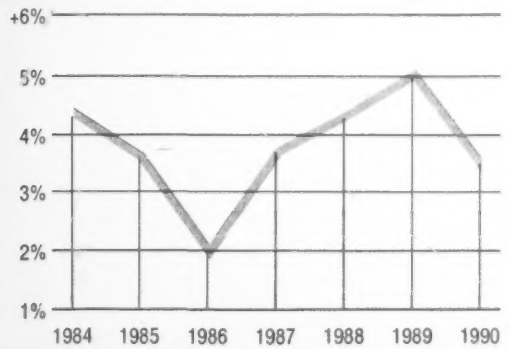
Overall, Cahners points out that 1989 will show almost no growth in U.S. shipments of electronics goods — a gain of just 0.8% that pales beside last year's 9.3% jump. And U.S. electronics production, Cahners says, will continue the gradual descent begun early in 1989, hitting the bottom of the curve sometime in the third quarter.

While the inevitability of a downturn is not in debate, its timing is. Others sense that business will head south no earlier than the last quarter of this year. According to Henderson Ventures, total U.S. electronics equipment production will still show a 6.5% gain over 1988, but 1990 will slow to a 3.3% annual percentage rate increase. Computers and office equipment will show one of the sharper slowdowns, from a 1989 boost of 8.4% to just 2.9% growth in 1990.

DRI is indicating that the first quarter of this year will show good results, but senior forecaster Wyss maintains that it'll be the last strong quarter for at least a year. He confirms that 1989 will be a slow year, but not a recessionary one: GNP growth will wilt from 4% last year to about 2.5% — the same level pre-

Inflation

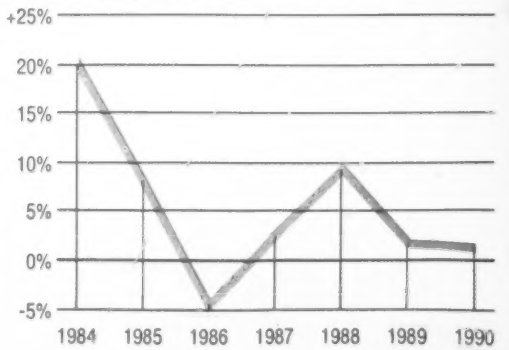
Annual percentage change in consumer prices



Sources: U.S. Labor Department and Cahners Economics

Business investment

Annual percentage change (1982 dollars)



Sources: U.S. Commerce Department and Cahners Economics

dicted by the consensus of economists polled by Sedona, Arizona-based Blue Chip Economic Indicators. DRI adds that the level of business investment growth will back off from last year's 18% surge to 6%. "Six percent isn't bad, but it's not 18%," says Wyss.

Lost computer momentum

Wyss' analysis of the downturn points to lost momentum in computer sales: last year, growth in production equipment, much of it computer-driven, provided 1.5 percentage points of total GNP growth, but this year, as unsensational replacement business becomes the dominant pattern of computer purchasing, it will drive a small fraction of GNP gains. "We're running out of new people to buy computers," notes Wyss.

A real fear, maybe just as factual as emotional, may come from an ailing dollar. Plunging close to a 40-year low against the Japanese yen one week after the presidential elections, the once-mighty greenback prompts deep concerns that it will fall much further — as low as ¥110 by year's end, warns DRI's Wyss. While that would clearly give exports another spin, it could be the crisis that forces the dollar into understudy status on the world currency stage.

Sounds gloomy? Sure it is. But it's not anything to get suicidal about: a second reading of the statistics reveals several solid fundamentals.

First, the forecasts are talking about growth rates, and just because there's been a decline in growth of electronics production or shipments of electronics equipment doesn't mean that there's no growth at all. A 1.7% increase in U.S. business investment dollars is an increase nonetheless.

Second: technically, this won't be a recession — it'll be more properly termed "a contraction," a downturn that won't bite too deeply. Some sources go so far as to indicate that there is no short- to medium-term likelihood of economic crisis even if the new administration does procrastinate on the budget deficit. In a mid-November report issued by the Brookings Institution, the Washington think tank, the authors concluded that America can probably muddle through, its growth financed by foreign investors.

The inevitability of a downturn is not in debate, but the timing is

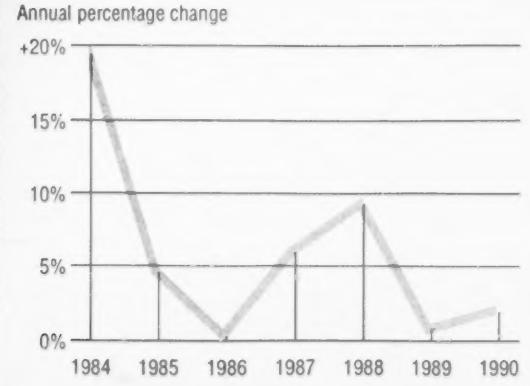
Cahners points to several more immediate reasons to be cheerful. Electronics shipments *will* recover, gaining 2.1% in 1990. Electronics distributors' shipments will come back more strongly still, with a positively buoyant 5.3% gain. The GNP will climb 2.7% and total U.S. industrial output will pick up 3.6% in 1990, and the prime interest rate, peaking at 10% in 1988's last quarter, will step down to an alluring average of 8.6% in the fourth quarter of this year. It'll hardly provoke dancing in the streets, but it's good news for much of the electronics industry, where cost of capital has become more and more of a worry.

The deficit manacle

But it'll be hard for Bush to dance with a deficit manacle on each ankle. The federal shortfall remains huge; the post-election noises from overseas hint that foreign nations may not have the confidence to invest indefinitely in the perceived strength of the Untied States' economy. The trade gap promises to be much tougher to whittle down than its recent diet might suggest.

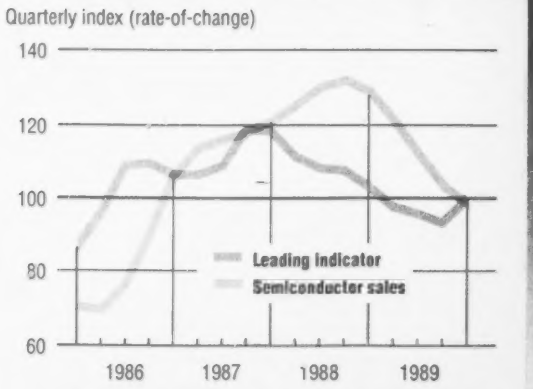
A lot now rests on the big shoulders of the next U.S. president. If he acts promptly to at least acknowledge the extent of the economic imbalances, the Brookings Institution forecasters will certainly be proved right. If Bush insists that Americans keep reading his lips, the United States could be faced with the worst of both worlds: a 1990 recession *and* no cure for the deficits. □

Electronics shipments



Sources: U.S. Commerce Department and Cahners Economics

ELECTRONIC BUSINESS leading indicator



Sources: Semiconductor Industry Association and Cahners Economics

Computer makers batten down for '89's tough times

Technology turmoil and economic uncertainty are squeezing mini and mainframe sales growth and braking PC and workstation sales

BY RICK WHITING

While far from the deep slump that hit the U.S. computer industry in 1985 and 1986, manufacturers are battening down the hatches in anticipation of a slowdown in nearly all segments of the industry in 1989.

U.S. shipments of computer equipment and office machinery grew about 12% to $68.6 billion in 1988. But economic uncertainty and evolutions in technology are expected to hold growth to a miniscule 1.2% in 1989, with total shipments climbing only to $69.3 billion, according to forecasts by Cahners Economics, the economic research unit of Cahners Publishing Co.

"There is some anticipation that 1989 is going to be a rough year," says Charlotte Walker, an analyst with County Natwest Securities USA. "All the signs show that demand is slowing."

Domestic sales of computer equipment are expected to remain in the doldrums, where they were for much of 1988. Although that was offset by increased international sales for many vendors, there are some signs that overseas sales growth may also moderate in 1989.

Spending for capital equipment by the manufacturing sector remains strong, although analysts detect an overall slowdown in capital equipment spending within the U.S.

Prime Computer Inc.'s experiences are typical. Prime expects its sales to the manufacturing sector to grow between 13% and 15% in 1989, but sales to the financial services and government sectors of the economy will likely remain "sluggish," according to Richard Goldman, CFO.

Customers confirm slower buying patterns. Marathon Oil Corp., which buys mainly DEC computers, is holding the line on expenditures for computer equipment in 1989. Given the uncertain oil market, the company's $3 million budget for scientific computer purchases this year is flat with 1988 expenditures, according to Michael Heagney, supervisor of worldwide systems and operations with Marathon's Exploration Computing Systems Group.

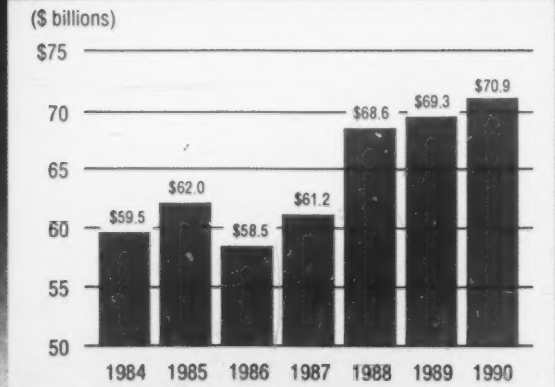
Analyst Walker says that for computer manufacturers, the trick will be to build sales and support infrastructure and continue research and development efforts for future growth, while keeping profit margins from sinking out of sight.

On goes the slump in minis

The slowdown in minicomputer sales that hit manufacturers in 1988 will continue into 1989, industry watchers say, with market growth continuing at the same sluggish 7%

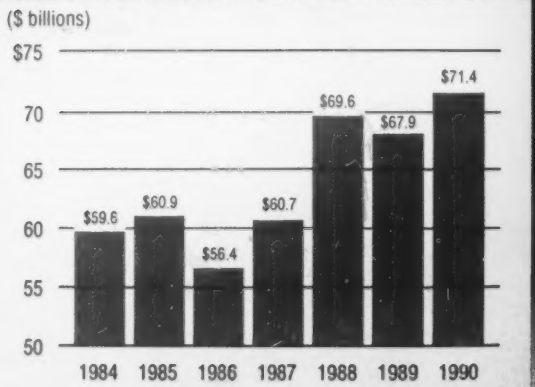
Computers and office machinery

Shipments



Sources: U.S. Commerce Department and Cahners Economics

New orders



Sources: U.S. Commerce Department and Cahners Economics

to 8% rate the industry saw in 1988. Sales growth for mainframe systems is also expected to hover at the same 5% to 7% pace of last year. International Data Corp. estimates that in 1988, total U.S. sales of minicomputers and mainframes reached $17.2 billion and $9.5 billion, respectively.

Minicomputer vendors are trying to sell systems into a saturated market, according to First Boston Corp. analyst Susie Peterson Case. "I think there is already a lot of hardware out there," she says. Particularly hard hit are high-end systems sold by Digital Equipment Corp., Prime, Tandem Computers Inc. and others.

Slower workstation sales

Workstations will likely remain the fastest growing segment of the computer industry, although slowing from the breakneck pace of 1988. Estimated worldwide sales of workstations last year were $3.6 billion, according to Dataquest Inc., with the Untied States accounting for about 60% of that. Industry watchers are still expecting workstation sales to grow anywhere between 25% and 50% in 1989. But DEC and IBM are expected to unveil more competitive workstation products during the year, turning up the heat on Apollo Computer Inc., Sun Microsystems Inc. and other vendors.

After showing a gain of 34% in 1987, personal computer revenue growth slowed in 1988 to an estimated 22%, according to Prudential-Bache Securities Inc. analyst Kimball H. Brown, who expects worldwide microcomputer sales growth to slow further to an estimated 17% in 1989. Dataquest estimates put total PC sales in the U.S. at $22.4 billion in 1988 and $24 billion in 1989.

What's more, this year is expected to be particularly difficult for so-called "second tier" PC vendors, while market leaders IBM, Apple Computer Inc. and Compaq Computer Corp. will increase their share of the microcomputer market. "The big will get bigger and the weak will get beat up," Brown predicts, noting that AST Research Inc., Wyse Technology and others are beginning to experience slower sales.

Users will likely spend much of 1989 assimilating the PCs bought since 1987 before buying new ones

Aside from economic factors, 1989 is expected to provide more than its share of hot issues on which the performance of various industry segments will hinge.

In the frantic personal computer market, the slow ramp-up of the OS/2 operating system and the continuing debate over IBM's Microchannel versus the proposed Extended Industry Standard Architecture (EISA) will create uncertainties among customers and hold down sales growth.

Higher prices for DRAMs and other components will also squeeze profit margins and prevent vendors from lowering prices and stimulating demand. And after buying huge numbers of microcomputers in 1987 and 1988, users are also expected to spend much of 1989 assimilating those products before making additional purchases.

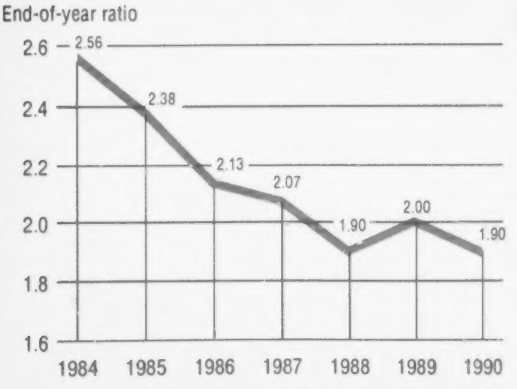
In the minicomputer arena, the transition from large host-based systems to desktop systems connected to network-based servers will force minicomputer makers to reevaluate their strategies and look to other areas for revenue growth.

DEC already plans a major push into the workstation market this year to help compensate for slow minicomputer sales. Systems software is expected to account for an increasing percentage of computer vendors' revenue, and many traditional hardware manufacturers will broaden their offerings to include systems integration and other services.

The continuing imbroglio over Unix, the RISC versus CISC debate and other issues will likely dominate 1989 as they did 1988 and further blur the sales growth picture for workstations and minicomputers. □

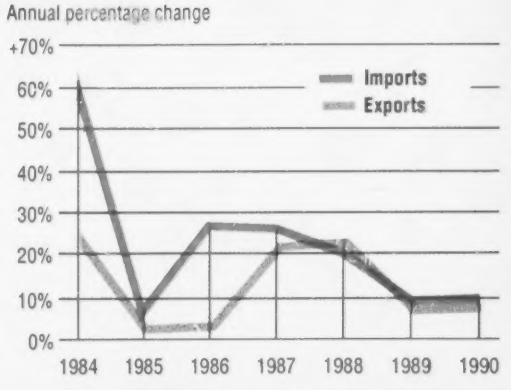
Computers and office machinery

Inventory-to-shipments ratio



Sources: U.S. Commerce Department and Cahners Economics

Trade



Sources: U.S. Commerce Department and Cahners Economics

Call waiting: Sales of telecom gear level off

Slack telecom equipment sales will be offset by continued gains in datacom. LANs, T-1 multiplexers and ISDN chips are the hot wires

BY ANNE KNOWLES

In an effort to educate its customers, AT&T recently ran an advertisement comparing today's plain old telephone service, wittily labeled POTS, to the futuristic Integrated Services Digital Network, or ISDN. Changing from the plain old telephone service to gloriously new and improved ISDN, says the ad, is like switching from a Model-T to an F-16 jet fighter. The ad then asks the question: You may have your driver's license, but are you ready to fly?

If the near-term outlook for the telecommunications industry is any indication, then the answer is apparently no. Widespread use of ISDN — which allows the transmission of voice, data and video over the same telephone lines — is a few years away. Meanwhile, the industry is in a transition period while it makes way for the future. As the ad explains, the switch to ISDN is an evolutionary process that will utilize existing equipment. As a result, large ticket items will experience little to no growth, while smaller, niche markets that are helping to pave the way forward will expand rapidly.

The datacommunications market is ready to soar. Users interested in tying together their computers, peripherals and other devices through networks are willing to spend money to do so.

In 1989, the U.S. telecommunications industry — equipment plus services — should grow 3%, to $141.5 billion, according to Dataquest Inc., a market research firm.

This slow-growth trend line applies particularly to communications equipment, as Cahners Economics, the economics research arm of Cahners Publishing Co., points out in its interpretation of U.S. Commerce Department statistics. According to Cahners, U.S. shipments of communications gear will inch up just 1.7% to $76 billion worth this year, compared with the 5.8% growth evidenced in 1988.

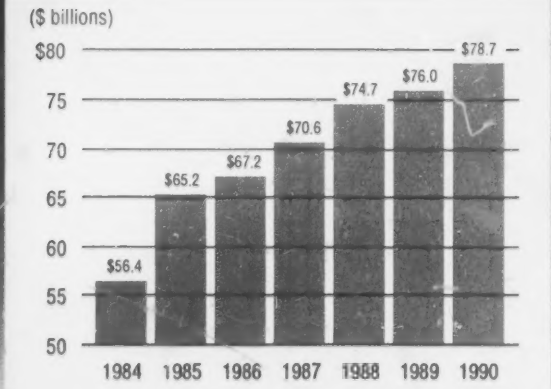
Dataquest's studies show that the services side of the U.S. market, which includes local, long-distance and public data services, will grow 3% to $130.2 billion. Public data services such as packet-switching and electronic mail should increase 5% to about $460 million.

But selected equipment sectors show more promise. Because packet switching is becoming more popular for global communications, says Katharine Korostoff, an analyst with International Data Corp. in Framingham, Mass., the U.S. packet-switching equipment market should climb about 12% to $282.9 million in 1989.

The public equipment piece, which includes transmission and switching

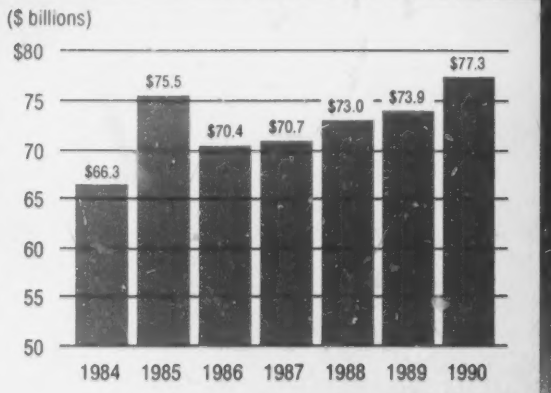
Communications equipment

Shipments



Sources: U.S. Commerce Department and Cahners Economics

New orders



Sources: U.S. Commerce Department and Cahners Economics

gear purchased by AT&T, the Bell Operating Companies and other common carriers (OCCs) such as MCI Communications Corp. and U.S. Sprint Communications Corp., is expected to rise 4% to $11.3 billion. The brightest spot in that segment is the U.S. market for fiber-optic equipment, projected to climb 20% to about $1.2 billion in 1989.

Specifically, U.S. sales of fiber-optic transmitters and receivers will be about $288.8 million, growing 35.2% compounded annually through 1992, while U.S. sales of fiber-optic connectors should climb to $46.6 million this year — this according to the Information Network, a market research firm in San Francisco.

Stagnant PBX sales

According to Dataquest, the business, or private communications market, which includes private branch exchanges (PBXs), key telephone systems and voice messaging, will reach $8.4 billion this year, 5% above last year's U.S. market. Stagnant sales of PBXs, estimated to be the same as last year's $3.1 billion, reflect the market's status as primarily for replacement and upgrade.

Upgrading PBXs to take advantage of ISDN is fueling a small but fast-growing market for ISDN chips. According to the Information Network, U.S. revenue from ISDN chips will reach $37.6 million in 1989, growing 303.8% compounded annually until 1992, when ISDN chip sales will hit $1.2 billion. The fastest growing application segment for the chips, says Robert Castellano, president of the market research firm, will be PBX conversion. The Baby Bells, all of which are currently undergoing or planning ISDN field trials, are the largest customers for the chips, he says.

Now for the best news. According to Dataquest, the datacommunications market in the United States will jump 18% to $7.2 billion this year. Despite the rosy outlook, some segments of the market are doing poorly. Sales of modems, for example, should drop 8%, to $1.2 billion, due in part to IBM's fall announcement of a 15-member modem family that will drive down prices in that market.

The U.S. packet-switching equipment market should climb about 12% to $282.9 million in 1989

But expected revenue in other areas of the U.S. datacommunications market will pick up the slack. Sales of T-1 multiplexers — digital transmission devices and lines that can handle voice or data or both at rates of up to 1.544 megabits per second — will jump 24% this year, to about $500 million. The highest growth for the industry is expected in the market for local area networks which should increase 39% to $3.6 billion, says Dataquest.

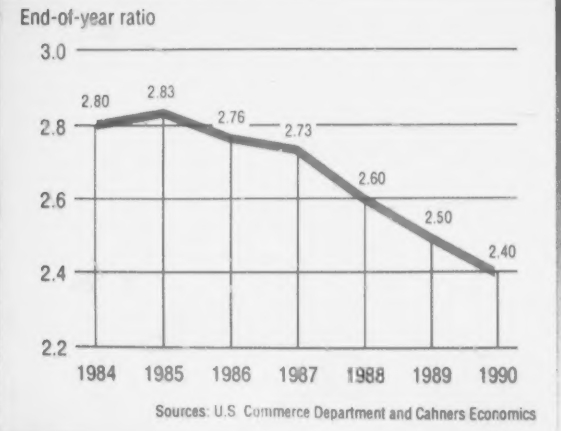
Fiber-optic LANs based on the Fiber Distributed Data Interface, or FDDI, will start having an impact on the market this year. Fibronics International Inc. last fall announced the first FDDI product — an Ethernet-to-FDDI bridge — using Advanced Micro Devices Inc.'s SuperNet FDDI chip set. AMD, which has a cross-licensing arrangement with Siemens AG for the chip set, currently has 50 beta sites for the product. The only other vendor offering FDDI chip sets is The Plessey Company Plc.

Revenue from fiber-optic LANs is expected to reach $84 million in 1989 in the United States, according to the Information Network. That figure includes sales of star-based and bus-based LANs; it does not include LANs based on token ring topology, such as FDDI, because such LANs have only recently been introduced.

However, the proliferation of LANs is driving the market for network management — a diversified set of hardware and software products designed to monitor and manage equipment on a network. According to IDC, U.S.-based vendor product revenue will grow 20% to $231.2 million this year. □

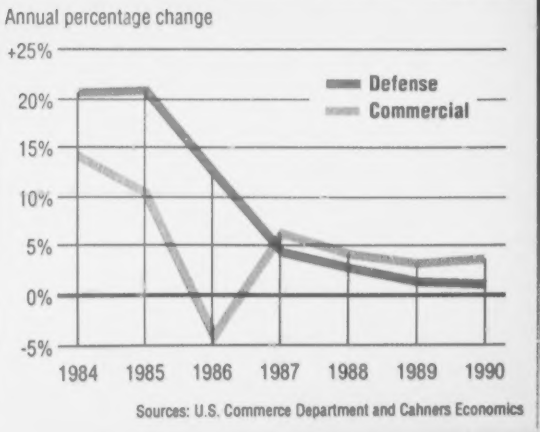
Communications equipment

Inventory-to-shipments ratio



Sources: U.S. Commerce Department and Cahners Economics

Defense vs. commercial shipments



Sources: U.S. Commerce Department and Cahners Economics

Slip yes, slump no for U.S. chip makers

With customers' inventory levels under control, U.S. chip makers can expect a 3% contraction in sales in 1989 but no replay of 1985

BY VALERIE RICE

Knock on wood, 1989 will not be a replay of the disastrous 1985 for the semiconductor industry.

But, although the market for semiconductors won't hit bottom in 1989, it won't set record growth rates either. Whether this year will be down, flat or slightly up, it certainly won't have the robustness of 1988.

What 1989 may have is a recession. Economists are split on whether the United States will enter a recession in 1989, 1990 or at some point later. So, forecasts for semiconductor growth in 1989 and beyond vary, based on when the expected recession will hit.

Cahners Economics, for example, is not predicting a recession in the next two years, merely a "contraction" in the economy. The Cahners Publishing Co. economics research arm forecasts that semiconductor sales in the United States will drop slightly in 1989 to $12.7 billion, which is down from $13.1 billion in 1988. Worldwide sales will also decline to $40 billion in 1989, down from $42.2 billion in 1988. Cahners predicts that the semiconductor industry will show a modest increase in growth in 1990, with worldwide sales rebounding to $42.8 billion by the end of that year.

The Semiconductor Industry Association (SIA), however, sees 1989 as a year of modest growth, with worldwide integrated circuit sales increasing 12.2% in 1989, and then declining 3.9% in 1990. Others, like market research firm In-Stat Inc., see an essentially flat market in 1989, with a rebound in 1990.

One way to sanity-check whether 1989 will be flat or just plain horrible is to look at inventory levels — that demon instrument of doom for chip manufacturers in 1984-85.

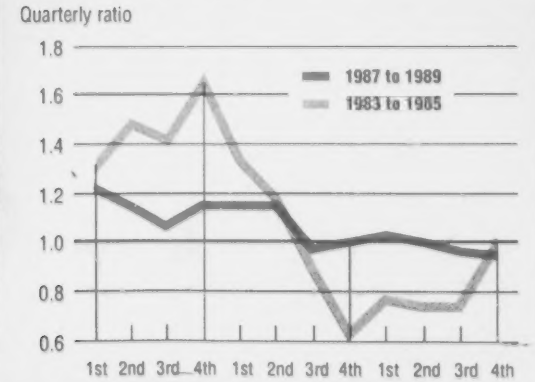
The good news seems to be, however, that inventory levels are more or less where they should be and that customers, far from stockpiling, are actually being reasonable in their orders.

In-Stat's president Jack Beedle notes that thanks to factors like just-in-time deliveries and better inventory tracking systems, customers are buying smarter, and paying more attention to inventory levels than ever before.

Chip companies, too, are carefully watching their customers, and overall, it seems to be working. Fujitsu Microelectronics Inc. recently conducted a survey of its customers' inventory levels, according to senior vice president and general manager Richard Christopher. Through September of 1988, Fujitsu's customers were under their own target levels in

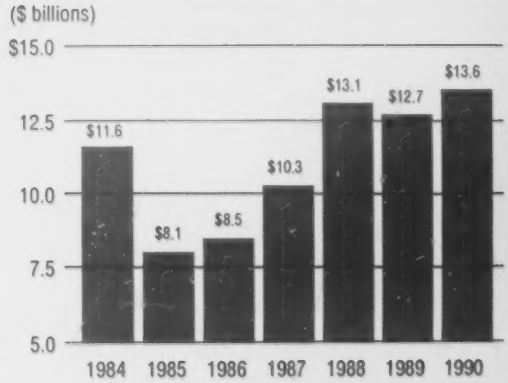
Semiconductors

U.S. book-to-bill ratio



Sources: Semiconductor Industry Association and Cahners Economics

U.S. semiconductor sales



Sources: Semiconductor Industry Association and Cahners Economics

inventories and had been under since the first quarter.

"We are seeing only minor inventory growth on passives and certain standard product areas," he says, "but on our types of products we're not seeing any buildup."

Texas Instruments Inc. is also tracking customer inventory levels, according to president Jerry Junkins. In 1982, the average TI customer had 11 weeks of inventory; as of October 1988, the average inventory had dropped to 5.3 weeks. That, according to Junkins, is a piece of good news.

Perhaps the only dissenting voice here is that of Intel Corp.'s microprocessor senior vice president David House.

"We're seeing strange things," he acknowledges. "Inventories are out of whack — too high in some areas, too low in others. Right now there's no way to tell if what we are seeing is the beginning of a downturn, or ju inventory-related [fluctuations]," House adds.

This inventory imbalance will negatively impact the company however; first quarter of 1989 sales will be less than expected, due to a glut of 80386's.

Where wild growth is — and isn't

The big winners in 1989 will be cutting-edge technology products, ASICs, telecommunications chips, and not too surprisingly, memories.

In general, CMOS logic and memory products will continue to be strong through 1989, representing an increasingly large share of solid state shipments. Specifically, logic products (including ASIC's and microprocessors) are expected to grow 23% in 1989, slowing to 4.3% in 1990, according to the SIA. Memories will come down from their dramatic 185.7% growth in 1988 to a more moderate 49.6% in 1989. But by 1990, the momentum will have slowed, with memories dropping 7.7% that year, according to figures from the SIA.

The winners in '89 will be cutting-edge technology products, ASICs, telecom chips — and memories

Some of this phenomenal growth, particularly in memories and microprocessors, will slow because of the decline in prices. High prices artificially supported the boom in 1988 (some say as much as 10% of the growth can be attributed to prices), so the lessened growth rates in 1989 are not out of line.

At Motorola Inc., microprocessor general manager Jack Browne is expecting a reasonable year, despite the downturn, due in part to the company's broad product line. Motorola's recent reentry into the DRAM market, combined with strong pushes into consumer areas and "good strong growth in the telephony area" should be sufficient to offset what Browne believes will be a down year.

Commodity doubts

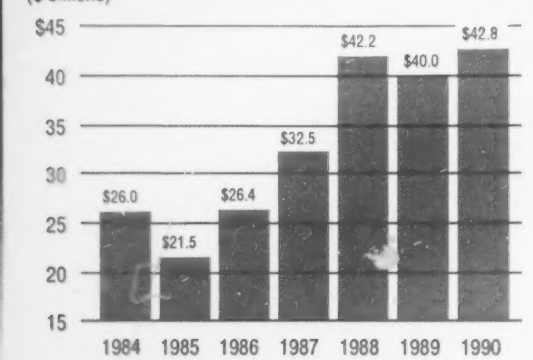
One area virtually every analyst agrees on is the inadvisability of dependence on commodity, PC-based products in the coming months.

At VLSI Technology Inc., president James Fiebiger is predicting that the "PC market will show some softness, particularly amongst the Asia/Pacific clone makers. We are working closely with the guys in the United States right now, and we think the outlook [for them] is quite strong. But we see some slowing in the Far East."

That view is echoed by Peter Hillen, strategic marketing manager at International Microelectronic Products Inc., who says that his company is "thinking of going into the hamburger business," because 1989 will likely be a somewhat rough year, with a recession proper showing up at year's end. IMP sells a lot of disk controllers, and right now the disk drive market is in the tank, Hillen says. "That was a big ding for us," he admits ruefully. □

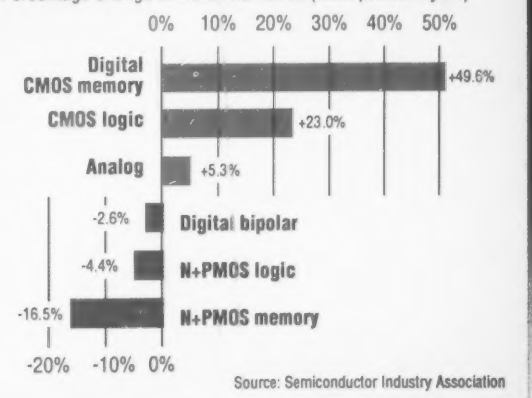
Semiconductors

Worldwide semiconductor sales



Sources: Semiconductor Industry Association and Cahners Economics

1989 semiconductor growth rates



Source: Semiconductor Industry Association

Capacitors lead the components charge south

Expect scant sales growth in switches, and an actual dive in capacitor business. Relays should hold up, as will connectors

BY JOHN McCREADIE

For many makers of resistors, capacitors, switches, relays, connectors and other passive components, the tough times are back.

They won't be nearly as tough as the dark days of 1985 — inventories have stayed under control and leadtimes are down — but 1989 is still going to show a slowdown in many sectors. The overall pattern is seen in the interpretation of U.S. Commerce Department statistics by Cahners Economics, the economics research arm of Cahners Publishing Co.: U.S. shipments of electronics components (including semiconductors — see separate article) will slip from last year's $55 billion to $53.9 billion.

The patterns are the same for specific passive-component segments: capacitor sales, predicts Cahners, will fall 5.1% this year, a sharp reversal of the 14.2% upturn seen in 1988.

Another market researcher, Venture Development Corp., foresees limited growth in U.S. shipments of switches, up from last year's $1.33 billion to $1.39 billion.

However, there are some pockets of better business performance. Relays, according to Venture Development, will produce U.S. shipments of $1.26 billion, up from 1988's $1.15 billion. And U.S. electronics firms will prove hungry consumers of connectors and IC sockets, gobbling up $4.48 billion worth in 1989, compared with $4.19 billion last year.

Also, sales growth is being sustained in surface-mount component categories, and in application-specific parts.

Overall, passives makers are looking forward with some caution. The lessons brought by the crash of 1985 are well-seeded as industry players concentrate on keeping tighter inventories and creating shorter leadtimes. But as OEMs continue to trim their vendor lists, this mature industry is being rattled by acquisitions, foreign competition and ever-increasing demand for top quality. All of which is forcing passives vendors into sweeter relationships with their customers.

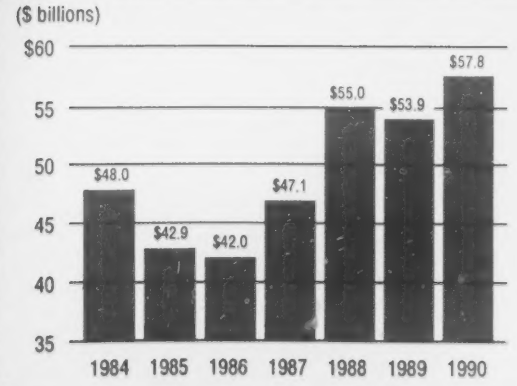
"The IBMs and big auto makers always thought they could beat up the vendors by having them compete against each other to get the lowest possible price," says Dick Kolster, product marketing manager for Siemens Components Inc. "Now, both suppliers and customers are seeking a better working relationship with one another."

Stop the war

Adds Marshall Butler, chairman of capacitor maker AVX Corp.: "The industry is trying to stop the war be-

Components

Shipments



Sources: U.S. Commerce Department and Cahners Economics

Inventory-to-shipments ratio

Sources: U.S. Commerce Department and Cahners Economics

tween the vendor and the OEM. They're trying to get their relationship more solid, where quality and service are more important than bombing the price."

Vendors indicate clearly that users are shifting away from price concerns and concentrating more on quality and service. However, price remains an issue. For most market segments, prices remained stable and there they will remain, at least for the first half of 1989, say analysts. One exception will be in the multilayer ceramic area, says Emmitt Graham, a market watcher with Woodside Market Research Inc. This product category, which accounts for most of the capacitors used in electronics applications, will continue to show price declines because of softening in the PC industry.

Beckman Industrial Corp. is counting on another year of price stability, according to Candia Bernstein, market research manager for the resistor manufacturer. "Although by the end of the year, things could be a little soft," she says. Bernstein points out that if prices do fall, the damage will be minimal because component makers are already operating on very small margins.

Leadtimes are being kept trim, too. Helped by improved relations between vendors and users, leadtimes are stable throughout the industry; Cahners Economics expects them to average 5.7 weeks this year, an improvement over last year's 6.2 weeks.

However, most component makers would agree with that forecast, many predicting improved leadtimes are on the horizon which may be a direct result of implementing paperless purchasing systems. Commenting on resistor maker Bourns Inc.'s new electronic data interchange program, Dennis Lause, vice president of electronic component sales for Bourns, says: "We can improve visibility, eliminate errors, reduce paper and speed the whole purchasing process."

Component leadtimes are expected to average 5.7 weeks this year, down from 6.2 weeks in 1988

At Siemens Components, Dick Kolster points to 1988 leadtimes for capacitors between eight and 12 weeks. "We would like to see it a little lower, maybe eight to 10 weeks," he says. At 3M Co., leadtimes are two to four weeks, a dramatic improvement from the six to eight weeks of just two years ago. Kolster adds that inventories are being kept low because "everybody is trying definitely not to get burned." Cahners indicates that the components inventory-to-shipments ratio closed 1988 close to a four-year low.

There is little doubt that today's components industry is global. According to Dick Evans, marketing and international director for the electronics division of 3M: "We're experiencing growth outside the United States equal to or greater than our growth inside the United States."

Meanwhile, all component companies are focusing on several key growth areas in the market. The automotive market is rapidly expanding, especially in the area of surface-mount components, says Siemens' Kolster.

SMT continues to evolve as more companies manufacture products using the technology. At Bourns, product marketing vice president Jeff Boyd expects SMT sales to double in 1989. "The good news is it will cross over into most market segments," he says. And worldwide consumption of SMT components is expected to hit $25.1 billion by 1992, according to Electronic Trend Publications, a Saratoga, California-based market research company.

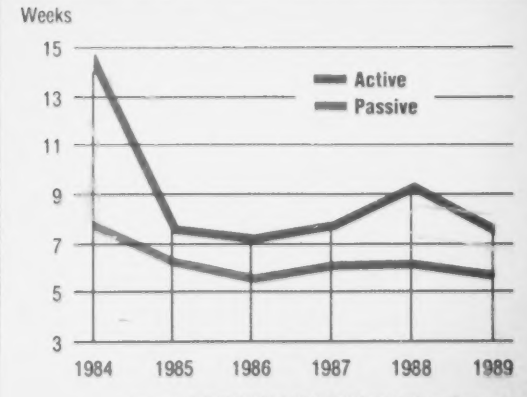
Application-specific (AS) components continue to be a fast-track market segment, and manufacturers relish the higher gross margins there. Connector maker Molex Inc. is currently doing 60% of its work with automotive customers in AS and over 90% is AS in its computers and peripherals markets. □

Components

Capacitor sales

Sources: Electronic Industries Association and Cahners Economics

Leadtimes



Sources: ELECTRONICS PURCHASING and Cahners Economics

ATE makers dig in for slow growth year

With just 4.3% growth, 1989 won't be as hot as board- and IC-tester firms might like. Scope vendors should still see strong sales growth

BY TONY GREENE

While 1988 was no banner year for the makers of test and measurement gear, it's a year that will be fondly remembered in 1989. According to market researcher Prime Data Inc., the total world market grew only 12.5% last year to total $7.9 billion. But in 1989, world sales are expected to show an even more lethargic growth rate of 6.4%, bringing the total dollar value of the market up to $8.4 billion.

In its broader analysis of the market for all scientific and engineering instruments, Cahners Economics, the economic research arm of Cahners Publishing Co., sees an identical pattern. U.S. shipments, Cahners predicts, will climb only 3.3% to $50.6 billion worth, compared with a 9.7% upturn last year.

The outlook for ATE is dismal too, notes Cahners, with predicted worldwide sales growth of 4.3% to $2.4 billion in 1989 after last year's 25.8% surge to $2.2 billion. Prime Data analyst Kenneth Neff foresees a tough year for the ATE makers: "I don't think we're going to see a negative year, but electronics is back in phase with the general economy and the economy is going to slow down with GNP growth between 1% and 1.5%."

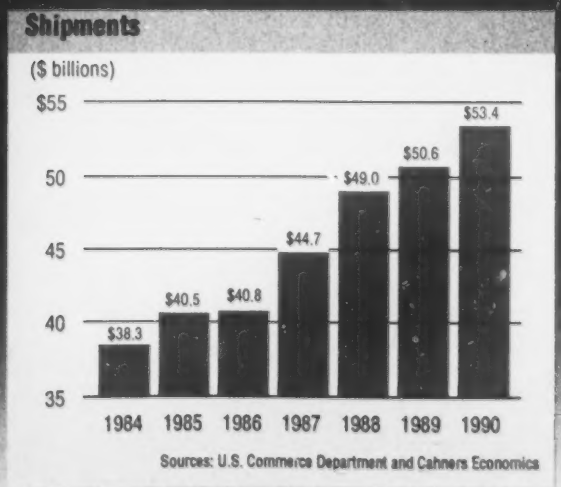
Neff expects the makers of IC test gear to be the hardest hit in the upcoming year, with sales growth of 3% in 1989 after a 27% spurt last year. Board test vendors should fare better, with sales growth down from 12% in 1988 to 5% in 1989. A shakeout remains a good possibility. According to Neff, "ATE firms are lean and mean already. They have control on their growth and they have their houses in order. ATE is already a mature market, but there is the potential for more consolidation."

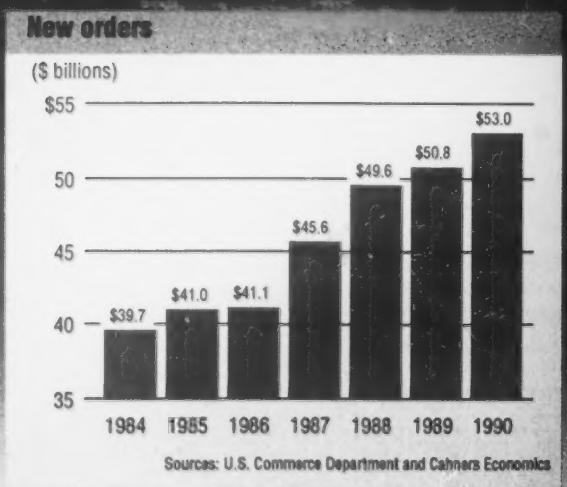
Vendors of IC test equipment don't plan to be caught napping. Says James A. Prestridge, vice president of the component test group for Boston-based Teradyne Inc.: "There is reason for caution but not pessimism. The year will be flat but could go plus or minus 10%. We are making plans for a flat year."

While most IC test-gear vendors agree that there will be a slowdown, they see good opportunities for growth, especially in particular segments such as memory chips and mixed analog/digital chips for communications uses. "Memory will see substantially higher growth than the logic," says Jim Mulady, manager for sales and marketing for Ando Corp. of Sunnyvale, Calif. "We could possibly see growth of 50% in memory equipment sales, specifically for static memories."

Steve Bisset, president of San Jose-based IC tester company Megatest

Scientific and engineering instruments





Corp., agrees, and also sees promise in VLSI test. "The growth of the RISC processor area is really taking off. There is going to be enough growth next year so that people who have survived so far will survive 1989," he says.

Pricing wars

That's for those in a position to wage pricing wars. "1989 is going to be a real market share fight year because there is a lot of test equipment capacity . . . The tester wars are going to continue and anybody who does well in 1989 has to gain some market share in the process," says Teradyne's Prestridge. Adds financial analyst Steven Balog of Shearson Lehman Hutton Inc. of New York City, "We have a price war in VLSI test, but at this point it doesn't matter; if you go from 1,000 degrees to 1,500 degrees your goose is still cooked." Others indicate that ATE vendors are coming in at 40% and 50% off to sell a logic tester, with 10% to 20% discounts a phenomenon integral to the industry.

The vendors in board test equiment are viewing things more conservatively. Joseph B. Lassiter Jr., Teradyne's vice president of manufacturing systems says, "1989 will be about like 1988. The board test business will be about flat. In board test we need to learn to live with this volume of sales. We've done a lot of work on margins and other forms of cost reduction." Lassiter also notes that Teradyne has let a healthy backlog build up in anticipation of a soft market.

Robert Anderson, president of Concord, Massachusetts-based GenRad Inc., is also planning conservatively for 1989 but sees the market growing some: "We are optimistic about board test and see it growing 10% to 20% in 1989. But from the planning standpoint we are keeping it pretty tight." Anderson says that new product introduction is key to GenRad's strategy for this year. "The challenge now is to do product development on an R&D budget that is 13% to 15% of revenue."

Discounts of 10% to 20% are a phenomenon integral to the IC-tester industry

Another factor that is tightening up the test equipment market is the increasing development and use of CAE software. CAE is reducing the number of prototypes necessary in the development of a product, which in turn decreases the need for test. "In the R&D environment you need the same instruments; you just don't need as many of them," says Galen Wampler, president of Prime Data.

The smaller players are still darting about looking for growth in niches. Says William Bean, president of Marconi Instuments Inc., "The low-end tester market is the most underdeveloped part of the market. That is where we are investing our future in the U.S."

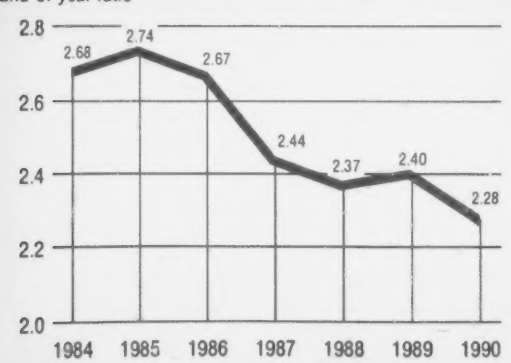
Scope hope

On the instrument side, Bean sees a reasonable growth year — a 10% to 15% uptick — but thinks it is going to be a hard year for instrument makers in general. "The real trick is going to be to find the mini-sectors of the market that are going to do well and get in them," says Bean. Wampler agrees: "We are going to see things slow down in 1989 and come back some in 1990." But he adds that digital oscilloscopes are going to be one of the fastest growing segments of the instrument market, showing 19% growtn this year after 30% growth in 1988. Instruments in general look slightly healthier than ATE for 1989, with sales of microprocessor development sytems expected to grow 11.5% and logic analyzer business growing 11.8%, according to Prime Data.

In a year in which revenue growth could be hard to come by, some observers believe that profitability will be a bigger issue than revenue growth. Very few test and measurement companies have shown much return on investment since 1984. □

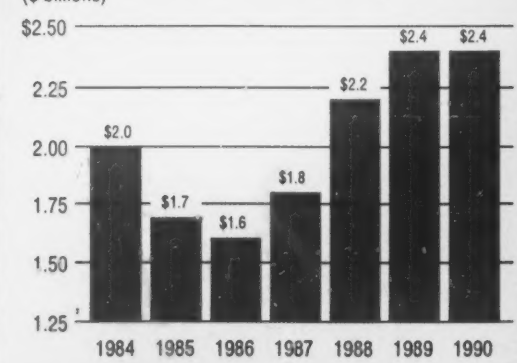
Scientific and engineering instruments

Inventory-to-shipments ratio



Sources: U.S. Commerce Department and Cahners Economics

Worldwide sales of automatic test equipment



Sources: ELECTRONIC BUSINESS and Cahners Economics

Units flat, dollar volume up in TV and stereo sales

U.S. homes are already packed with TVs and VCRs, so unit sales won't thrive. But consumers are still going for big-ticket items

BY PAULA DOE

Consumers won't be spending so freely in 1989. That means flat sales of consumer electronics goods, in units. But some dealers see double-digit growth in dollar volume in TVs and audio equipment, as those buying are choosing pricier products.

Cahners Economics sees meager 0.3% growth in U.S. consumer spending on durable goods in 1989. Inventories are piling up across the economy, bringing cutbacks in factory output, fewer overtime hours and fewer jobs. "People are going to cut back," says Cahners economist Madeline Franchi. "Next year isn't going to be a great year."

"Consumer spending patterns will be flat for 1989," concurs Edward Henderson, president of Henderson Ventures, a market research firm.

Less consumer spending means flat unit sales of major consumer electronics products. Cahners projects a 3% decline in the number of color TVs sold to U.S. dealers. Although sales of VCRs will increase by a meager 1%, total volume will still remain 4% below the 13.3 million units sold in 1987. Some 60% of all U.S. households already have a VCR.

People may not be buying more electronic equipment, but they *are* buying more expensive models. So dealers still expect healthy dollar volume increases in key sectors. When total consumer spending edged up 2.4% in the second quarter of 1988, for example, consumer electronics spending leaped 13.5%, as people continued to buy enhanced TVs, better stereo equipment and camcorders. The Electronic Industries Association notes that 27% of all color TVs sold in the U.S. in 1988 had stereo sound.

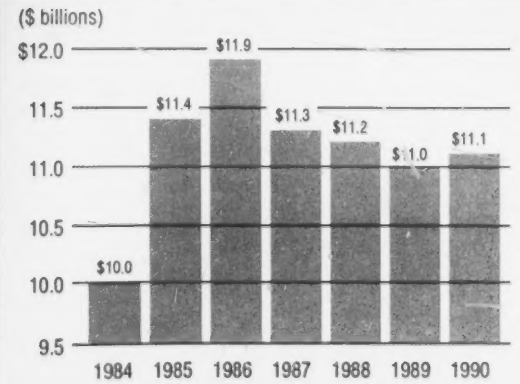
"The good news is really strong numbers in color television," asserts Peter Edwards, president of Video Only Corp., a retail chain. He projects 5% to 10% growth in dollar value of TV sales for 1989, due to increased demand for the pricier large screen and stereo sets. "Enhanced TV will be *the* consumer electronics product of the '90s," Edwards believes.

There's similar optimism over high-end television at Silo Inc., a national electronics retailer. "Although TV sales in units are flat or declining, we expect significant growth in dollar volume over the next three years — into double digits," predicts Roger Salmons, a company VP.

Unfortunately, it's not U.S. producers making these higher value consumer electronics products. Shipments from factories in the United States will slip another 1.5% in 1989, down to $11 billion, according to Cahners' forecast. □

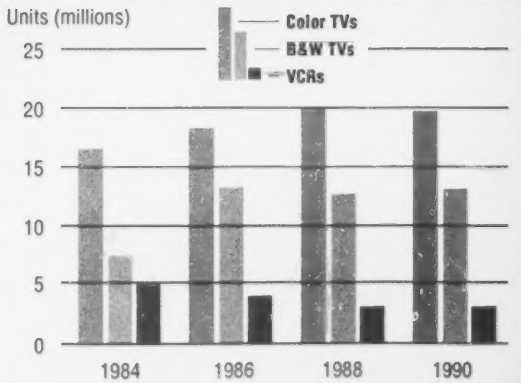
Consumer electronics

U.S. television and radio shipments



Sources: U.S. Commerce Department and Cahners Economics

U.S. sales to dealers



Sources: Electronic Industries Association and Cahners Economics

Real decline forecast for defense

Planning for a slowdown? You should be. Even electronics will come under the knife as the budget cutters go to work

BY BRUCE C.P. RAYNER

Despite the Republican victory last November, there is not much happy talk among defense contractors these days. Peace seems to be breaking out around the world, the U.S. defense budget is shrinking and the industrial base is in need of a fixup. In such a climate, electronics is bound to feel a crunch.

Defense forecasters generally agree that zero or negative real growth will be the norm for the next five years. The Electronics Industry Association (EIA), for example, expects total defense spending to drop from $295.8 billion in fiscal 1988 to a low of $274.9 billion by fiscal year 1994, measured in constant fiscal 1989 dollars. Only in 1995 will the defense budget begin to turn positive and continue to grow at a lackluster pace through the rest of the century.

The slowdown is mirrored in short-term production statistics from Cahners Economics, the economics unit of Cahners Publishing Co. As a result of the budget cutbacks, defense and space production will grow at an annual rate of just 0.1% this year —a slight improvement over the 0.5% decline last year — and then nose dive with a 3.7% contraction next year.

The picture is bleak in electronics too. The overall electronics content of the defense budget is expected to drop from $52.8 billion in 1989 to a low of $51.9 billion by fiscal 1994, the EIA predicts, but will rebound to $54.6 billion by fiscal 1998.

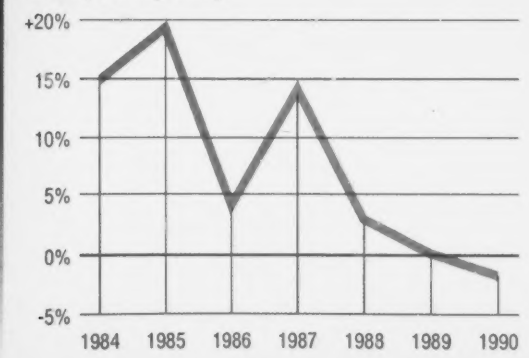
However, the main reason for the slowdown is the urgent need to reduce the federal budget deficit. Sam Nunn, (D-Ga.) chairman of the Senate Armed Services Committee, warns that the defense budget will have to be cut by over $300 billion between now and 1995 if federal budget targets are to be reached.

Now for the good news. While there is no silver lining to this cloud, opportunities do exist for forward looking electronics firms. For instance, while the number of platforms — vehicles, aircraft and ships — will decline, industry experts expect the number of retrofits and upgrades to increase. Case in point: enhancements to the B-1B's troubled avionics suite, à la Eaton Corp.'s AIL division, will cost somewhere between $300 million and $3.4 billion between 1990 and 1994, sources say.

One business that shows particular promise is verification. As a result of the Intermediate Nuclear Force (INF) treaty and possibly a Strategic Arms Reduction Talks (START) treaty sometime this decade, on-site verification expertise will be sought. Those experts that designed the missile systems will be needed to help destroy them. □

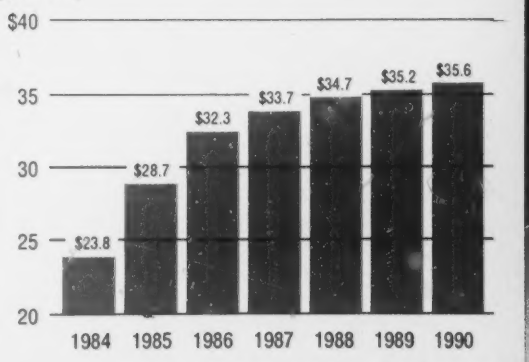
Military

Defense electronic equipment purchases



Sources: U.S. Commerce Department and Cahners Economics

Defense communications equipment shipments



Sources: U.S. Commerce Department and Cahners Economics

India: Struggling to enter the electronics age

The largest democracy in the world has an ambitious high-tech goal: Electronics production of $33 billion by the year 2000

BY BRUCE C.P. RAYNER

From a backward, agrarian-based society held captive by unpredictable monsoons, India is fast becoming an international player in high technology. Electronics production in the world's second most populous nation reached $4.4 billion last year, according to preliminary government estimates, and is expected to grow at around 30% a year for the remainder of the century. But several factors — including the government's insistence on self-reliance, a penchant for bureaucratic meddling and an inadequate industrial infrastructure — could derail the country's ambitious plans.

Nevertheless, India is attracting the keen attention of many multinational electronics companies. For firms in the United States such as Apollo Computer Inc., AT&T, Digital Equipment Corp. and Tektronix Inc., long-term access to the huge domestic market has clearly outweighed the short-term hassles. In telecommunications alone, the Indian government plans to spend $37 billion to implement 16 million more phone lines by the turn of the century. In this, the first of a two-part feature, ELECTRONIC BUSINESS probes India's struggle to enter the electronics age and examines how U.S. firms can best take advantage of the market opportunities there.

Vying for Yankee dollars

For several reasons, India has it over its Pacific Rim and Latin American rivals when it comes to vying for Yankee dollars: English is the unofficial business language there; the country is politically stable; and the labor force is cheap and technically sophisticated. As for the bottom line, profits are easily repatriable and tax holidays are negotiable. The country also provides a gateway to markets in Eastern Europe, Africa and the Middle East.

Direct investments from the West have grown steadily since Prime Minister Rajiv Gandhi came to power in late 1984. As a result, the U.S. pulled ahead of the Soviet Union three years ago as India's top trading partner. In 1987, the U.S. government granted close to 4,000 commercial licenses for the export of high-technology products worth $563 million to India, according to the U.S. Department of State. The figures were up sharply from the 714 licenses, valued at $23.2 million, approved in 1983.

Similarly, the United States led the list of total number of joint ventures, including ones in electronics, formed with Indian companies in 1987. The United States had 196, or 23% of the total, according to the Indo-American Chamber of Commerce. West Germany was second with 149 and Great Britain third with 122.

In total, electronics production in India has grown by nearly three and a half times in the last four years, from about $1.3 billion in 1985 to $4.4 billion last year, the Department of Electronics reports. (The DOE, charged with setting industrial policy, is the government agency responsible for licensing production.) Electronics production is forecast to grow at around 40% to $7.5 billion next year and could hit $33 billion by the turn of the century, according to one optimistic estimate.

But despite India's grand hopes of becoming an electronics powerhouse, several drawbacks exist. Two of India's top priorities are the country's insistence on self-reliance and sovereignty, policies that frustrate foreign investors. Unlike its Pacific Rim neighbors which have opened their arms to foreigners bearing high-tech know-how, India's modernization agenda keeps tight reins on what foreigners can and cannot do in the country.

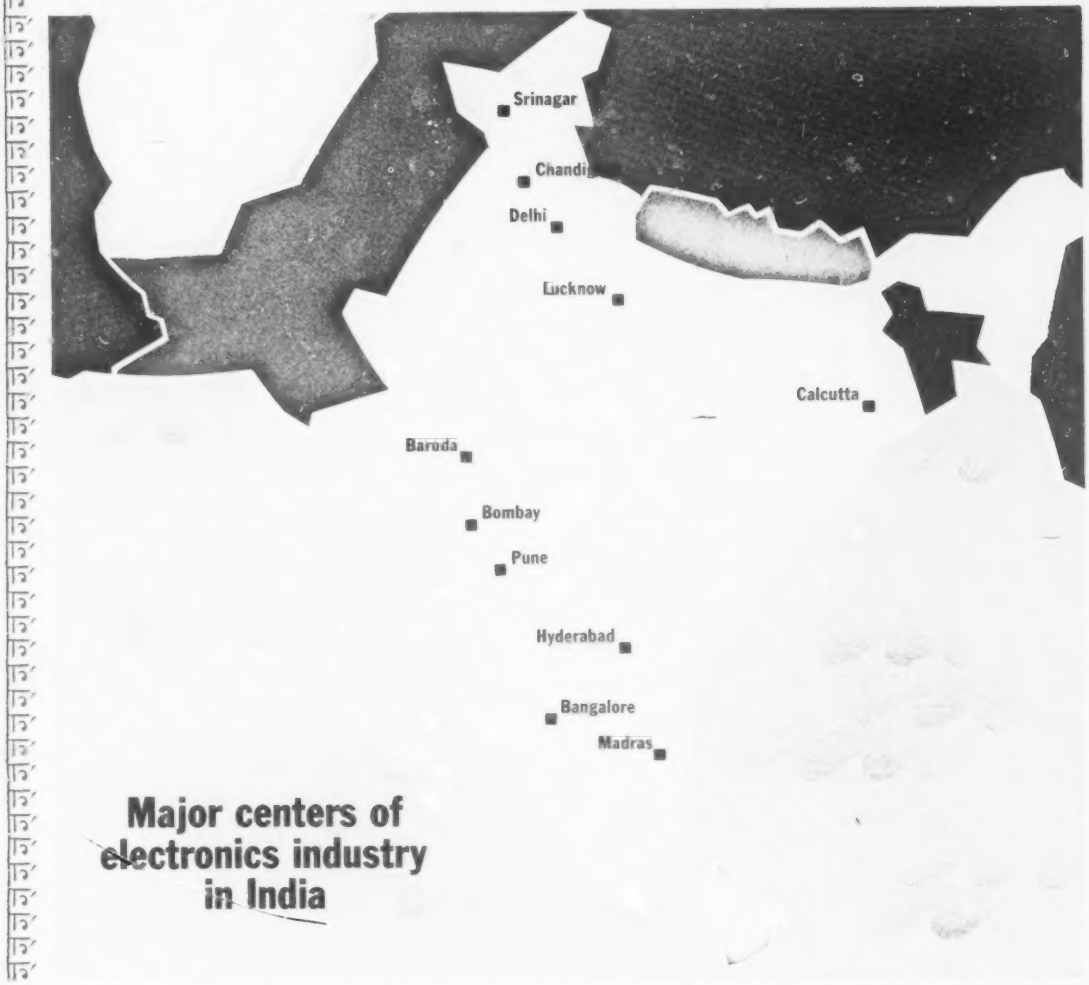
India's electronics output

($ millions)

	1984	1985	1986	1987	1988*	1989*
Consumer	$221	$394	$691	$856	$1,771	$2,568
Instrumentation/ industrial	168	225	271	352	629	1,394
Computers	52	62	104	188	344	584
Communications/ broadcasting	181	215	255	338	652	945
Defense	100	132	149	201	276	362
Components	154	203	275	342	643	1,409
Software	50	69	57	97	119	262
Total	**$926**	**$1,300**	**$1,802**	**$2,374**	**$4,434**	**$7,524**

* Based on estimates by the DOE and ELECTRONIC BUSINESS
Conversion rate: 14.9 rupees = $1

Source: Department of Electronics, Government of India



Major centers of electronics industry in India

Anne Gusmar

The biggest constraint is the government's cap on foreign equity ownership. As a result, some foreign companies are hesitant to jump in. Others have withdrawn. IBM pulled out in 1978 after the Indian government forced foreign companies to dilute their equity ownership from 100% to the present 40%. However, rumor has it that Big Blue is currently exploring new opportunities in the country.

India's resolve to determine its own future is understandable. Having gained independence from Britain only 40 years ago, the last thing the country wants is to become the chattel of another Western master. This translates directly into government policy. Imported technology must be transferred to an Indian partner and strict timetables for indigenization of production and local sourcing are painstakingly negotiated.

Running rampant

Government involvement runs rampant. Critics insist the biggest obstacle to growth is *not* access to technology but the many layers of bureaucracy. From the section officer within the DOE to the cabinet minister, there exist 10 levels of government bureaucrats that must sign-off on foreign investments, according to one source. Although the DOE prides itself on its quick turnaround time for joint venture applications — if all goes according to plan, the process takes about three months from start to finish — most collaborations take between 12 and 18 months to get off the ground.

Then there are the cross-governmental approvals. All told, there are six or seven major bureaucracies that foreign investors must deal with on their way to setting up shop in India. These range from getting a production license to being given foreign exchange approval from the Reserve Bank of India.

Over the years, the country's policy makers have controlled production through strict licensing. They have insulated domestic manufacturers — mainly government-controlled public companies — from outside competition, critics contend. Because of the huge unemployment problem in In-

dia, the government encouraged indigenous firms to enter markets and set up manufacturing. But the government has not allowed those same firms to exit if and when they become economically untenable. Such coddling has bred inefficiency, and it has also made the status quo fat.

Underneath this bureaucratic morass, lies an inadequate industrial infrastructure. For the foreign electronics company accustomed to Western conveniences, doing business in India is a rude awakening. Electricity brown-outs are commonplace; transportation between states is slow; and long-distance telephone lines are of poor quality. Improvements are underway but, as of now, they've only come in fits and starts. □

[*Conversion rate: 14.9 rupees = $1*]

Taking the plunge

What you need to know about doing business in India

Foreign firms interested in exploring business opportunities in India have several basic options.

The simplest and cheapest way for you to enter the Indian market is by setting up a liaison office to investigate the local business prospects. This is ostensibly an exploratory venture involving no direct selling. AT&T opted for a liaison office in its first step at marketing into India. (AT&T also has an Indian joint venture with Dutch firm N.V. Philips.)

To sell your product, the common approach, condoned by the government, is to set up a distribution network with an Indian partner. But be forewarned, India's distribution system is unique. In most cases, your Indian partner will not be allowed to stock your product, but must rely instead on his customer to initiate the order process. In this way, a distributor acts more like a consultant or systems integrator than a warehouser.

You should note that although the distribution industry has existed for years in the hardware business, it is a fairly new phenomenon in software. In fact, it was only about two years ago that Microsoft Corp. set up a distribution relationship with Tata Unisys Ltd., a Bombay-based software consulting firm which is a joint venture between Tata Sons Ltd., an Indian conglomerate, and Unisys Corp. Also, Ashton-Tate is gearing up for its debut on the Indian scene.

Besides distribution agreements, another option for foreign investors is the collaborative venture. These come in two flavors: technology transfer and equity participation. Technology transfers usually involve the licensing of products or processes in exchange for a lump-sum payment plus annual royalites. Equity investment agreements are more complex and are recommended only for the seasoned Indophile.

But equity participation is the way to go if managerial control is a priority for you. This is the course that both Tektronix Inc. and Digital Equipment Corp. have taken in their relationships with Bombay-based Hinditron, a leading hardware and software company in India. Similarly, Hewlett-Packard Co. is in negotiations with its distributor, Blue Star Ltd., to set up a manufacturing operation in the near future.

Tektronix had been distributing products in India for over 20 years and, as a follow on, began assembling some low-tech oscilloscopes in one of Hinditron's Bangalore plants about 18 months ago. Based on the success of the line, Tek formed a joint venture with Hinditron late last year and recently took the company public.

"Our intention is to make this a whole company with Indian-based vendors, manufacturing, marketing, training and research and development," states Langdon Hedrick, Tektronix corporate representative in Bangalore. Tektronix has a controlling 40% of the joint venture's shares. The public owns 30% and Hinditron holds the remaining 30%, according to Hedrick.

For DEC, the decision to manufacture in-country was somewhat forced. Because India is trying to expand its own minicomputer industry, it limits imports of those machines. To protect its dominant market share in India — DEC is the No. 1 computer vendor in India and IBM is second — DEC chose to set up a manufacturing operation even though Kenneth Olsen, DEC's chief executive, has said India would be better off importing its machines.

Another business option that the government is pushing hard, particularly in the software area, is the 100% export business that allows 100% foreign ownership. Many of these companies are located in export zones near international airports and can import duty free any hardware they

U.S. high-tech trade with India

($ millions)	1986		1987	
	Exports	Imports	Exports	Imports
Communications equipment and electronic components	$104.2	$11.4	$110.0	$15.9
Aircraft and parts (except engines/turbines)	104.4	0.1	118.2	0.1
Engines/turbines and parts	30.7	3.6	44.9	1.3
Office equipment and computers	86.7	15.1	94.8	4.0
Ordnance	0.05	0.6	0.06	0.5
Instruments	71.2	5.7	82.8	6.7

Source: U.S. Department of Commerce

deem necessary in their operations.

For example, CitiCorp Overseas Software Ltd. has a facility just outside Bombay in the Santacruz Electronics Export Promotion Zone. The company specializes in financial services software and claims sales last year reached nearly $4 million. CitiCorp expects to boost its software business in India by 100% annually for the next few years. □

Getting hitched

Finding the right partner in India is the most important decision you will make

Matchmaking is taken seriously in India. And nowhere is it taken more seriously than in collaborative ventures between foreign and Indian companies. Whether it is distribution or manufacturing, the single most important decision you will make in India is the choice of a partner.

Because of strict limitations on foreign participation, your Indian partner will act as your ears, eyes and voice in any dealings with the myriad government agencies. The better your Indian partner knows the system, the quicker you'll be able to get your products into the market there.

First and foremost, take great pains to ensure that your partner is aboveboard. Petty corruption is rife in India just as in any developing country, so vetting any prospective partners is critical. The litmus test for honesty is a proven track record, say veteran collaborators.

But no matter how much you trust your partner, it is still worthwhile keeping a corporate representative in the country just to watch over the venture's operations. Even though your representative will probably have little legal authority over your Indian partner, a close liaison helps nip potential conflicts in the bud.

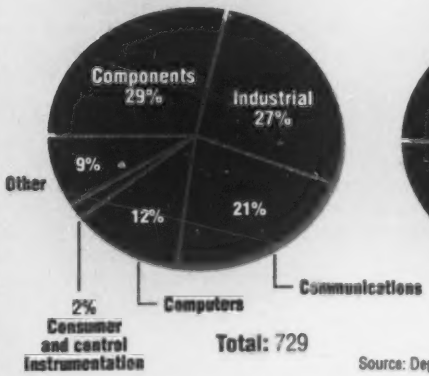
There are several agencies that can assist you in background checks. A good starting point is the U.S. Department of Commerce in Washington, D.C., or the Counselor for Commercial Affairs at the U.S. Embassy in New Delhi. Other countries provide the same services at their embassies in the Indian capital.

Two other sources of information are the Indo-U.S. Chamber of Commerce, located in Bombay, and the Confederation of Engineering Industry (CEI), headquartered in New Delhi. Both have offices in Washington, D.C., and the CEI has additional offices in London and Moscow.

For additional matchmaking information, you should also consider the local Non-Resident Indian (NRI) community. They can usually be found wherever high technology flourishes. The NRIs have close ties with government and industry in India and can offer advice on working within the Indian electronics environment. One of the strongest NRI communities is the Silicon Valley Indian Professions Association, based in Santa Clara, Calif. □

India's foreign collaborations

Where they were made...
Total number approved in electronics (1977 through 1986)



...and who made them
Approvals by countries in electronics (cumulative through 1986)

Source: Department of Electronics, Government of India

Keeping the pirates at bay

The job of protecting your intellectual property in India is perilous.

Even though India has a tradition of copyright, trademark and patent protection that dates back to the early days of the British Raj, many foreign electronics companies complain that the laws are not adequately enforced. As a consequence, software piracy runs rampant and technology transfers need to be conducted with caution.

"We are a developing country, so we must have the opportunity and freedom to innovate," says K. Nambiar, secretary of the Department of Electronics (DOE), India's government agency that sets industry policy. "At the same time, we are totally respectful of the property rights, acts and patent laws," he adds. Such a double-edged opinion keeps foreigners on their toes.

Outsiders have a more critical view of the country's intellectual property practices. India's copyright protection for software is "dismal," asserts Richard Hevron, Microsoft Corp.'s business development manager for Africa, India and the Middle East. Nonetheless, Microsoft was the first major software company to dive into the Indian market with a distribution deal inked with Tata Unisys Ltd., a large Indian software firm. Like China and Brazil, the Indian market was just too big to ignore, says Hevron. He adds that even though India's

1984 software amendment to the Copyright Act of 1957 is similar to legislation in the developed world, "it does not have any teeth, or we are not being very effective with it."

But that is about to change. The National Association of Service and Software Companies is involved in a media blitz on the evils of software copyright infringement. Sources say Microsoft plans to file suit against one or two of India's worst offenders in an attempt to focus attention on the value of software.

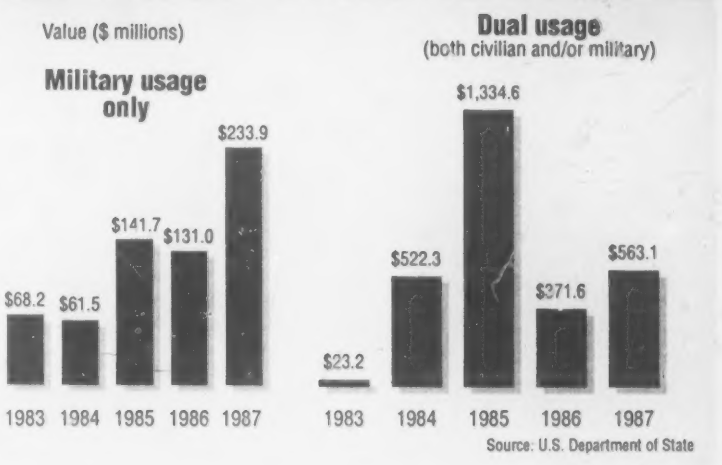
Still, no one is holding his breath as the Indian judicial system is infamous for its protracted proceedings. It may be years before pirates feel the pinch, worry U.S. executives. And even though the government promises to give equal protection under the law, some foreigners question whether this will actually be the case.

Problems exist for chip protection too. India is a participant in the United Nations' World Intellectual Property Organization, which is currently trying to hammer out an internationally acceptable semiconductor protection agreement. The options are either a treaty based on America's 1984 Chip Protection Act or an Indian-recommended codicil to the Berne Convention that would extend copyright protection to chip designs. Most likely, WIPO will adopt a variation on the U.S. act, maybe as early as this year.

As for patent protection, India has a 1970 act on the books that is fairly thorough. However, the country is not a member of the Paris Union International Industry Property Convention. Still, any foreigners can theoretically get the same protection under Indian law if they patent their product in the country.

But the best property protection, contends Langdon Hedrick, Tektronix Inc.'s liaison officer in India, is to constantly keep one technological step ahead of the pirates. Tektronix, claims Hedrick, has been doing business in India for over 20 years with such a strategy. □

U.S. technology licenses to India



Source: U.S. Department of State

Giving government the slip

Getting the government out of business is far from easy in India. Just ask the country's semiconductor industry

In India, what the government says goes. It's that simple. So when the politicians listen to outsiders, it's worth taking note. In the case of the country's semiconductor industry, it's worth taking a lot of notes.

Last year, 10 highly respected Indian scientists, five from the United States and five from India, made recommendations to the Indian government on how to expand the domestic semiconductor industry. The Joint Scientific Committee, as it was called, suggested India aim for semiconductor production capacity of about $1.5 billion by the year 2000, which would require a total investment of about $3 billion between now and then.

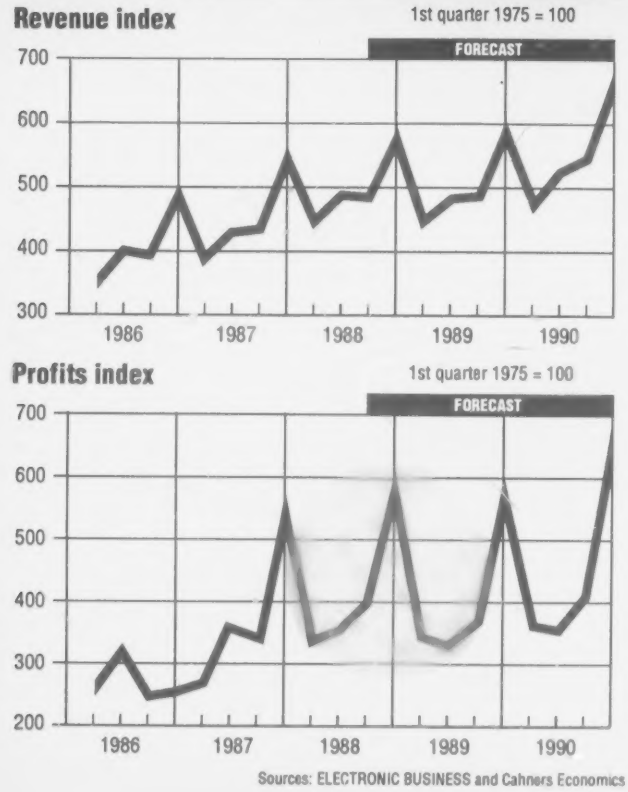
The innovative idea was that only 20% of that investment should come from the government, with the rest coming equally from Indian and foreign private concerns, says committee member Krishna Saraswat, professor of electrical engineering at Stanford University. The idea was that the proposed $2.4 billion in private investment would be motivation enough to insure efficiency and the $1.2 billion in foreign investment would insure leading-edge technology, reasoned the industry gurus.

Elements of the committee's proposals are indeed being adopted. For example, per the committee's recommendation, 10 design centers for application-specific integrated circuits are being set up around the country. But the government will be loathe to relinquish total control over the chip industry, critics contend. Still, even if the recommendations are only halfheartedly embraced, the committee's framework still sets the tone for the future: more open competition, less government control and more international involvement.

As a direct outcome of the committee's recommendations, Saraswat says, VLSI Technology Inc. of San Jose recently signed a technology transfer with Indian Telephone Industries Ltd. (ITI) to produce 1.5-micron very large scale integrated chips at ITI's fab in Pune.

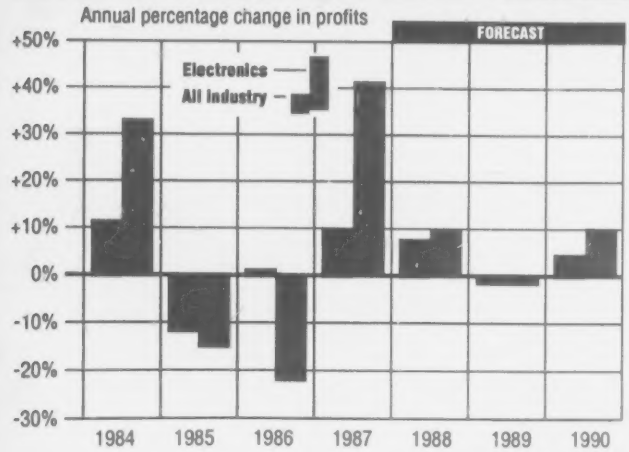
"We see India as a huge opportunity," declares Cliff Roe, director of Strategic Programs at VLSI Technology, "but they definitely have a different way of doing business." Barriers include currency controls and a sluggish bureaucracy, he complains. But with help from the Joint Scientific Committee, some of those barriers are being whittled away. □

ELECTRONIC BUSINESS indexes



Sources: ELECTRONIC BUSINESS and Cahners Economics

Profit growth: Electronics versus all industry



Sources: U.S. Commerce Department and ELECTRONIC BUSINESS

Profit forecast: 1989 will not be a rerun of 1985

Recent evidence indicates that 1989 will be no 1985. Example: revenue grew 10.6% in the third quarter of 1988, compared with a year earlier for the 16 electronics companies included in the ELECTRONIC BUSINESS index. That's down from 14.9% growth in the first quarter, but still healthy. Profits grew 15% in the third quarter.

Revenue growth by the top U.S. electronics makers has accelerated well into 1988, but that growth will be slowing down in 1989. And profits, after picking up 41% in 1987 and an estimated 9% in 1988, will most likely drop again this year, the first decline since the gloomy years of 1985 and 1986.

These forecasts won't make Wall Street happy, but industry executives will find the 1989 perspective easy to live with. Why? Because the profit picture will not be a rerun of the 1985 horror classic.

Profits at electronics companies tumbled 17% in 1985 and again down 24% in 1986. While electronics profits plummeted, all indusry after-tax profit dropped only 13% in 1985 and managed to inch up 2% in 1986. That was the first time since ELECTRONIC BUSINESS began tracking industry profits in 1975 that electronics fared worse than the rest of the economy.

Over the next couple of years, the electronics profit forecast will mirror profit gains in the entire U.S. industrial market. In fact, in 1990, if the economy can stave off a recession, electronics profits will again be outracing the rest of industry.

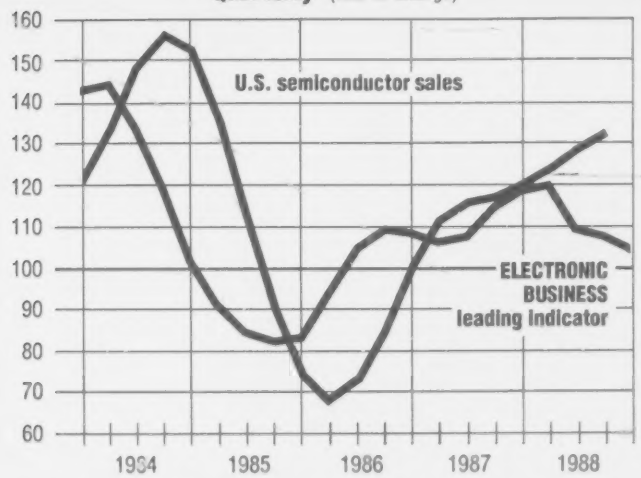
What's changed between 1985 and 1989? First of all, everyone these days looks at inventory far more carefully. Gone are the days of double- and triple-ordering and subsequent serious inventory overhang, at least for the next 365 days. With inventory management doing its job, other management tasks have also been planned much more cautiously. Operating costs are being held down and export markets are being promoted — all like never before.

Don't underestimate the impact of those juicy export markets. As long as the value of the dollar doesn't take an unexpected turn upward, made-in-the-USA computers, instruments and other electronic products will be easier to sell at lower prices abroad. In fact, of the companies ELECTRONIC BUSINESS tracks, those with the largest shares of foreign revenue fared the best in 1988 and should do so again this year.

ELIZABETH B. BAATZ

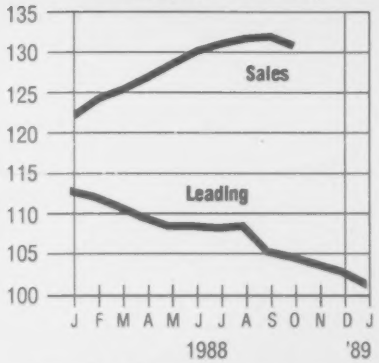
ELECTRONIC BUSINESS leading indicator

Quarterly (rate-of-change)



The ELECTRONIC BUSINESS leading indicator predicts turning points in U.S. semiconductor sales with about a three- to nine-month leadtime. For more information please contact Elizabeth Baatz, senior economist, Cahners Publishing Co., 275 Washington St., Newton, Mass., 02158, or call (617) 558-4368

Monthly (rate-of-change)



The ELECTRONIC BUSINESS leading indicator continues to inch downward. From a peak of 120 set in October 1987 the indicator has fallen only 19 points by January. Compare that with the 1984 experience. Fifteen months after the January 1984 peak, the indicator had lost 60 points. Clearly, the 1989 slowdown will be far different, and easier than 1985.

Source: Cahners Economics

Electronics industry indicators this month

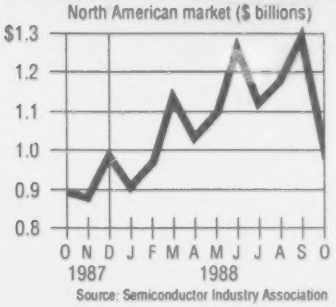
	Latest month	Previous month	Year ago	1987 average
ELECTRONIC BUSINESS leading indicator (rate-of-change, Sept.)	105.6	108.8	117.7	111.1
U.S. semiconductor bookings ($ millions, 3-month average, Oct.)	$1,064	$1,166	$1,006	$951
Weekly hours of semiconductor production workers (monthly average, Sept.)	40.2	40.1	40.2	40.6
Electronic components leadtime index (1977 = 100, Nov.)	99.8	109.7	96.7	100.7
S&P's semiconductor stock price index (1970 =10, monthly average, Oct.)	48.1	51.0	68.5	65.5
Change in electronic components inventories ($ millions, SA, Sept.)	+$72	+$115	+$71	+$41
Contract and orders for plant and equipment ($ billions, SA, Sept.)	$38.4	$43.7	$34.5	$34.6

SA = seasonally adjusted, all other data is not seasonally adjusted

Sources: Semiconductor Industry Association, U.S. Bureau of Labor Statistics, *Electronics Purchasing* magazine, Standard & Poor's, U.S. Commerce Department, U.S. Bureau of Economic Analysis

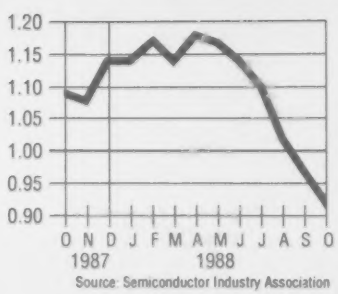
Semiconductor sales

North American market ($ billions)



Source: Semiconductor Industry Association

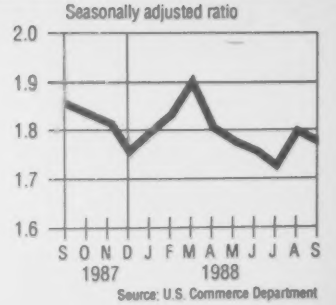
Semiconductor book-to-bill ratio



Source: Semiconductor Industry Association

Component inventory-to-shipments

Seasonally adjusted ratio



Source: U.S. Commerce Department